



Xian MA60 of the Zambian Air Force (Robert Hewson)

1040447

FLYING CONTROLS: Conventional mechanical. Mass-balanced, servo-compensated ailerons with electrically actuated trim tabs; tab in each elevator; electric trim/servo tab in rudder. Hydraulically actuated single-slotted (inboard) and double-slotted (outboard) trailing-edge flaps; landing deflection 30°.

STRUCTURE: Conventional light alloy; two-spar wing, with spot-welded skins; bonded/welded semi-monocoque fuselage.

LANDING GEAR: Retractable tricycle type with twin wheels on all units. Hydraulic actuation, with emergency gravity extension. Multidisc, anti-skid carbon brakes on mainwheels; hydraulically steerable (±45°) and castoring nosewheel unit. Min ground turning radius 12.47 m (41 ft).

POWER PLANT: Two 2,051 kW (2,750 shp) Pratt & Whitney Canada PW127J (PW127G in cargo version) turboprops, each driving a Hamilton Sundstrand 247F-3 four-blade, composites, constant-speed, fully-reversible 'scimitar' propeller. Fuel in integral wing tanks immediately outboard of nacelles, and bag-type tanks in centre-section, total usable capacity 7,200 litres (1,902 US gallons; 1,584 Imp gallons). Provision for additional tanks in centre-section. Optional pressure refuelling point in starboard engine nacelle; gravity fuelling point above each tank.

ACCOMMODATION: Crew of two on flight deck, plus one or two cabin attendants. Standard layout has four-abreast seating, with centre aisle, for 52, 56 or 60 (with forward wardrobe removed) passengers at 76 cm (30 in) pitch in air conditioned, soundproofed and pressurised cabin. Galley and lavatory at rear on starboard side. Wardrobes forward and aft of passenger cabin, plus overhead stowage bins in cabin. Passenger airstair door on port side at rear of cabin; emergency exit opposite. Freight door forward, starboard. All doors open inward. MA60M can accommodate 40 armed troops or 24 stretchers.

SYSTEMS: Honeywell GTCP36-150 (CY) APU. Hydraulic system, pressure 157 bar (2,280 lb/sq in), for actuation of flaps, landing gear extension/retraction, nosewheel steering and anti-skid braking system; emergency system for trim, flaps and wheel brakes. Electrical power supplied by 12 kW, 28 V APU-driven AC generator and two 115/200 V, 400 Hz static inverters; two 24 V, 43 Ah Ni/Cd batteries for emergency power and engine starting. Pneumatic de-icing of wing and tail leading-edges and engine intakes; windscreen, propeller blades and sensors anti/de-iced electrically. Oxygen system for passengers and crew. Fire detection and extinguishing system.

AVIONICS: Comms: Bendix/King dual KTR 908 VHF, single KHF 950 HF and KXP 756 ATC transponder; Hamilton Sundstrand AV 557C CVR; Becker 3100 audio system; Chinese FJ-30A FDR.

Radar: Rockwell Collins WXR-350 weather radar; Honeywell ACAS II collision avoidance system.

Flight: Dual VIR-32 VOR/ILS/marker, dual ADF-60A, dual DME-42 and ALT-55B low-altitude radio altimeter (all Rockwell Collins); Universal UNS-1M nav system; Sfenia H321AKM1 standby horizon.

Instrumentation: Four-tube EFIS-85 (B14), ADS-85 air data system, APS-85 autopilot and dual AHS-85 attitude and heading systems (all Rockwell Collins); Honeywell MkVII GPWS.

Avionics upgrading continuing in 2006, assisted by Honeywell and Rockwell Collins.

ARMAMENT (MA60-MPA): Six external stores stations: two on fuselage sides, each for 1,000 kg (2,205 lb) load; two inboard (each 1,500 kg; 3,307 lb) and two outboard (each 500 kg; 1,102 lb) under wings. Fuselage stations can each support two torpedoes, a 1,000 kg bomb, sonobuoy container or gun pod. Inboard wing stations suitable for drop fuel tank, anti-shiping missile or AAM. Outer wing stations able to carry single torpedo, 500 kg bomb, searchlight, gun pod or additional AAM.

DIMENSIONS, EXTERNAL:

Wing span	29.20 m (95 ft 9½ in)
Wing chord: at root	3.50 m (11 ft 5¼ in)
at tip	1.095 m (3 ft 7 in)
Wing aspect ratio	11.4
Length overall	24.71 m (81 ft 0¼ in)
Fuselage max width	2.90 m (9 ft 6¼ in)
Height overall	8.855 m (29 ft 0½ in)
Wheel track (c/l of shock-struts)	7.90 m (25 ft 11 in)
Wheelbase	9.565 m (31 ft 4½ in)
Propeller diameter	3.96 m (13 ft 0 in)
Passenger door: Height	1.405 m (4 ft 7¼ in)
Width	0.75 m (2 ft 5½ in)
Forward freight door: Height	1.22 m (4 ft 0 in)
Width	1.19 m (3 ft 10¾ in)
Rear baggage door: Height	1.41 m (4 ft 7½ in)
Width	0.75 m (2 ft 5½ in)
Emergency exits (two, each):	
Height	0.93 m (3 ft 0½ in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Passenger cabin: Length	10.795 m (35 ft 5 in)
Max width	2.685 m (8 ft 9¾ in)
Max height	1.905 m (6 ft 3 in)

Aisle width	0.435 m (1 ft 5¼ in)
Width at floor	2.395 m (7 ft 10¼ in)
Baggage compartment volume: front	5.0 m³ (177 cu ft)
rear	4.5 m³ (159 cu ft)

AREAS:

Wings, gross	74.98 m² (807.1 sq ft)
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WEIGHTS AND LOADINGS (A: passenger, B: cargo, C: MPA):

Operating weight empty: A	13,700 kg (30,203 lb)
Max usable fuel: A, B	4,030 kg (8,885 lb)
C	7,500 kg (16,535 lb)
Baggage capacity: front	540 kg (1,190 lb)
rear	300 kg (661 lb)
Max payload: A, B	5,500 kg (12,125 lb)
Max T-O weight: A, B	21,800 kg (48,060 lb)
C	24,000 kg (52,910 lb)
Max ramp weight: A, B	21,900 kg (48,281 lb)
Max landing weight: A, B	21,600 kg (47,620 lb)
Max zero-fuel weight: A, B	19,200 kg (42,329 lb)
Max wing loading: A, B	290.7 kg/m² (59.55 lb/sq ft)
C	320.1 kg/m² (65.56 lb/sq ft)
Max power loading: A, B	5.32 kg/kW (8.74 lb/shp)
C	5.86 kg/kW (9.62 lb/shp)

PERFORMANCE (A, B and C as above):

Max cruising speed: A	278 kt (514 km/h; 319 mph)
Econ cruising speed: A	232 kt (430 km/h; 267 mph)
Max operating altitude: A	7,620 m (25,000 ft)
C	8,500 m (27,880 ft)
Service ceiling, OEI: A	3,920 m (12,860 ft)
B	4,000 m (13,120 ft)
T-O run: A	810 m (2,660 ft)
T-O to 10.7 m (35 ft): A	1,100 m (3,610 ft)
C	969 m (3,180 ft)
T-O field length: A	1,425 m (4,675 ft)
B	1,400 m (4,595 ft)
C	650 m (2,135 ft)
Landing from 15 m (50 ft): A	1,060 m (3,480 ft)
Landing field length: A	1,460 m (4,790 ft)
Landing run at MLW: A	760 m (2,495 ft)

Range:

with 56 passengers, 100 n miles + 45 min reserves	
A	772 n miles (1,430 km; 888 miles)
B	567 n miles (1,050 km; 652 miles)
with max fuel:	
A	1,322 n miles (2,450 km; 1,522 miles)
B	1,187 n miles (2,200 km; 1,367 miles)
C	2,591 n miles (4,800 km; 2,982 miles)
Max endurance: C	12 h

XAC WJ

Chinese name: Whoshan Jiaolian

TYPE: Twin-jet freighter.

PROGRAMME: Revealed (as model) at Airshow China, Zhuhai, November 2004, though few details provided. Reportedly in 50-passenger/20-tonne gross weight size class and



Model of XAC WJ twin-turboprop unveiled at Airshow China in November 2004 (Robert Hewson)

1044646

prospective short/medium-range successor to abortive Y-7H; but described in one account as "destined for training of crews and for experimentations".

DESIGN FEATURES: High-mounted, sweptback (supercritical ?) wings with underwing podded engines; circular-section fuselage; T tail.

LANDING GEAR: Tricycle type; retractable (main gear into fuselage-side bulges). Twin wheels on each unit.

POWER PLANT: Twin turbopfans.

Colombia

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Former Agrocopteros Ltda established by Sen Tedesco in 1971, initially producing own autogyro and biplane agricultural sprayers and, from 1982, acting as local agent for RotorWay 162 two-seat helicopter. In 1980 built first of 12 Goldwing glass fibre canards and began manufacture of low-wing versions of metal Zenair designs, these leading to MXP-640 Amigo and MXP-650 Amigo-S. MXP-740 Savannah and MXP-740-F aerial sprayer based on Zenair CH-701 formula; both Amigo and Savannah later manufactured independently in Europe by ICP. MXP-100 Aventura open ultralight.

Became Tecnologias Aeronauticas (Aerot) in 1988 and began marketing MXP-800 Fantasy in 2002. Further change to current company name was followed by launch of MXP-1000 Tayrona in 2005. By that time had produced some 450 aircraft, of which 80 per cent exported.

Factory area 835 m² (9,000 sq ft).

AEROANDINA MXP-1000 TAYRONA

TYPE: Side-by-side ultralight.
PROGRAMME: MXP-740/750 series evolved into MXP-800 Fantasy, which further developed as Tayrona.
CUSTOMERS: Initial European sales in France and Italy, beginning 2005.

DESIGN FEATURES: High, constant-chord wing braced by streamlined V struts and auxiliary struts each side. Sweptback fin and low-set, sweptback tailplane. Cockpit cut away at rear. Leading-edge slats omitted to increase cruising speed.

FLYING CONTROLS: Conventional and manual. Flaps. Flaperons on prototype and first three production aircraft only.

STRUCTURE: Generally of 6061T6 aluminium alloy, with 4130 steel cage protecting cockpit.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, cantilever spring mainwheel legs and steerable nosewheel.

POWER PLANT: One Rotax liquid-cooled flat-four: 58.8 kW (78.9 hp) 912 UL; 73.5 kW (98.6 hp) 912 ULS; or 84.6 kW (113.4 hp) 912 ULS Turbo. Total fuel capacity 92 litres (24.3 US gallons; 20.2 Imp gallons).

DIMENSIONS, EXTERNAL:

Wing span	10.00 m (32 ft 9¾ in)
Length overall	6.30 m (20 ft 8 in)
Height overall	2.40 m (7 ft 10½ in)

DIMENSIONS, INTERNAL:

Cabin max width	1.16 m (3 ft 9¾ in)
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AREAS:

Wings, gross	12.30 m ² (132.4 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	290 kg (639 lb)
Max T-O weight	450 kg (992 lb)

PERFORMANCE (Rotax 912 ULS Turbo):

Max level speed	113 kt (210 km/h; 130 mph)
Cruising speed at 75% power	108 kt (200 km/h; 124 mph)
Stalling speed, flaps down	31 kt (56 km/h; 35 mph)
Max rate of climb at S/L	372 m (1,220 ft)/min
T-O run	40 m (135 ft)
Landing run	80 m (265 ft)
Range at 75% power	523 n miles (970 km; 602 miles)
g limits	+6/-3



Aeroandina MXP-1000 Tayrona 1158678

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In addition to producing its own JA-177 Evolution, Aerodynos is a local agent for the RotorWay 162 Exec two-seat helicopter kit manufactured in the US.

AERODYNOS JA-177 EVOLUTION

TYPE: Side-by-side ultralight/kitbuilt.
PROGRAMME: European debut at Blois RSA rally, 2005.
CUSTOMERS: At least seven produced by 2005.

COSTS: USD45,000 complete, as described; USD26,500 engineless standard kit; USD21,000 basic kit (plus tax; 2006).

DESIGN FEATURES: High, constant-chord wing with single streamlined bracing strut each side. Sweptback fin with low tailplane.

FLYING CONTROLS: Conventional and manual. Flaps.

STRUCTURE: Generally of aluminium alloy.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring cantilever mainwheel legs; steerable nosewheel. Wheel fairings. Hydraulic brakes. All wheels 5.00 aluminium.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS liquid-cooled flat-four driving an Ivo-Prop Helix variable-pitch (electric) propeller. Fuel capacity 125 litres (33.0 US gallons; 27.5 Imp gallons).

SYSTEMS: Electrical system with 12 V 18 Ah battery.

DIMENSIONS, EXTERNAL:

Wing span	9.12 m (29 ft 11 in)
Length overall	6.75 m (22 ft 1¾ in)
Height overall	2.00 m (6 ft 6¾ in)

DIMENSIONS, INTERNAL:

Cockpit max width	1.05 m (3 ft 5¼ in)
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AREAS:

Wings, gross	13.50 m ² (145.3 sq ft)
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Aerodynos JA-177 Evolution ultralight (R W Simpson)

1037962

WEIGHTS AND LOADINGS:

Weight empty	265 kg (584 lb)
Max T-O weight	495 kg (1,091 lb)
PERFORMANCE:	
Max level speed	110 kt (203 km/h; 126 mph)

Normal cruising speed	105 kt (195 km/h; 121 mph)
Stalling speed	31 kt (57 km/h; 36 mph)
Max rate of climb at S/L	510 m (1,673 ft)/min
T-O run	60 m (200 ft)
Landing run:	120 m (395 ft)

GLASS

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Three types of light aircraft are currently under development by this company which was formed in January 1999. One of these is a light utility twin with Rotax engines, to be known as the TwinGlass. No development timetable has been announced for this aircraft.

The company had a workforce numbering 72 and in November 2001 reported production at around four aircraft per year. In September 2004 control of Glass Aircraft was seized by Colombian Police. No evidence of recent sales or promotion of company's products.

GLASS STOLGLASS SG70

TYPE: Two-seat lightplane.

PROGRAMME: North American marketing launched at AirVenture, Oshkosh, in July 2003 with a US-registered demonstrator; returned following year.

CUSTOMERS: Venezuelan Yaracuy state government reported to have ordered 12 aircraft of which three delivered by November 2001. By May 2002, 27 aircraft had been built. Orders for 2002 numbered 45. One in US only.

DESIGN FEATURES: Short-field performance. Constant-chord, high-lift, high-mounted mainplanes with V-strut bracing resemble those of Zenith CH 701, Sweptback fin and root-mounted tailplane.

FLYING CONTROLS: Conventional and manual, Junkers ailerons and flaps. No aerodynamic balances on tail surfaces.

STRUCTURE: Generally of glass fibre.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted cantilever main legs with hydraulic brakes. Speed fairings on all wheels.

POWER PLANT: One flat-four piston engine; option of 73.5 kW (98.6 hp) Rotax 912 S or 84.5 kW (123.3 hp) Rotax 914, each driving a three-blade propeller. Fuel capacity 76 litres (20.0 US gallons; 16.7 Imp gallons).

ACCOMMODATION: Two persons, side by side. Baggage area behind seats. Door each side.

DIMENSIONS, EXTERNAL (Rotax 912 or 914 engine):

Wing span	9.15 m (30 ft 0 in)
Length overall	6.50 m (21 ft 4 in)
Height overall	2.57 m (8 ft 5 1/4 in)

WEIGHTS AND LOADINGS:

Weight empty	330 kg (727 lb)
Max T-O weight	600 kg (1,322 lb)
Max power loading: 912	8.16 kg/kW (13.41 lb/hp)

PERFORMANCE (Rotax 912 or 914 engine):

Never-exceed speed (VNE)	121 kt (225 km/h; 140 mph)
Cruising speed at 75% power:	
912	100 kt (185 km/h; 115 mph)
914	109 kt (201 km/h; 125 mph)
Stalling speed, power off:	
flaps up	31 kt (57 km/h; 35 mph)
flaps down	26 kt (49 km/h; 30 mph)
Max rate of climb at S/L: 912	335 m (1,100 ft)/min
914	366 m (1,200 ft)/min
Service ceiling: 912	4,265 m (14,000 ft)
T-O run: at S/L, ISA: 912	50 m (165 ft)
914	45 m (150 ft)
at 1,220 m (4,000 ft), ISA: 912	125 m (410 ft)
914	120 m (395 ft)
Landing run	130 m (430 ft)
Range: 912	365 n miles (675 km; 420 miles)
914	347 n miles (643 km; 400 miles)

GLASS SPEEDGLASS

TYPE: Two-seat lightplane.

PROGRAMME: First flown June 2003. Unknown number supplied to Venezuelan police for highway patrol and border control in 2003.



STOLGlass SG70 two-seat lightplane (Paul Jackson)

1042791



Prototype Glass SpeedGlass

0561678

COSTS: Company estimated unit cost at USD45,000 in 2002.

DESIGN FEATURES: Low wing with winglets; sweptback fin with root-mounted tailplane.

FLYING CONTROLS: Conventional and manual. No aerodynamic balances on tail surfaces.

STRUCTURE: Generally of glass fibre, with carbon fibre and duralumin.

LANDING GEAR: Tricycle type. Mainwheels retract inwards; nosewheel rearwards.

POWER PLANT: Not specified. Three-blade propeller. Fuel capacity 114 litres (30.0 US gallons; 25.0 Imp gallons).

DIMENSIONS, EXTERNAL:

Wing span 8.75 m (28 ft 4½ in)
 Length overall 7.50 m (24 ft 7¼ in)
 Height overall 3.20 m (10 ft 6 in)

WEIGHTS AND LOADINGS:

Weight empty 450 kg (992 lb)

Max T-O weight 800 kg (1,763 lb)

PERFORMANCE (estimated):

Never-exceed speed (VNE) 156 kt (290 km/h; 180 mph)

Cruising speed at 75% power 130 kt (241 km/h; 150 mph)

Stalling speed, power off:

flaps up 53 kt (97 km/h; 60 mph)

flaps down 44 kt (81 km/h; 50 mph)

Max rate of climb at S/L 304 m (1,000 ft)/min

Service ceiling 4,570 m (15,000 ft)

T-O run, ISA: at S/L 200 m (660 ft)

at 1,220 m (4,000 ft) 350 m (1,150 ft)

Landing run 400 m (1,315 ft)

Range 955 n miles (1,770 km; 1,100 miles)

Czech Republic

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Established on 1 July 1953, Aero Vodochody is the successor to the Aero Aircraft factory founded in Prague in 1919. Over the years it has produced more than 11,000 aircraft, most notably the L-29 Delfin (3,665 built) and more than 2,800 L-39 Albatros jet trainers. Most recent programme concerned the L159, last of which for the Czech Air Force was delivered in February 2004.

The company underwent a change of ownership as part of a restructuring programme approved on 31 July 1996, when it had yet to recover fully from debts occurring in 1990–91. It became a joint-stock company in which the majority shareholder was the Czech government, through shares held by Letka a.s. (35.66 per cent) and the Konsolidační Banka (29.00 per cent). From 17 August 1998, a further 35.29 per cent was acquired by Boeing Česká s.r.o., a joint venture comprising Boeing and Czech Airlines (CSA), owned 90 per cent by Boeing and 10 per cent by CSA. The remaining 0.05 per cent of Aero was owned by other shareholders. However, Boeing decided to withdraw its participation in early 2004; terms agreed on 11 October 2004, whereby Boeing's Česká holding repurchased by Czech government for nominal CZK2.53 per cent being allocated to Letka and 47 per cent to the Konsolidační Banka, making the company 99.96 per cent state-owned. Workforce at end of 2003 was about 2,000, but reduced to 1,600 in 2004, ending that year with CZK300 million profit largely due to work on S-76C+ programme.

Company is currently organised into four main business units: Military Aircraft, Civil Aircraft, Aero Structures and Sikorsky. Aircraft programmes are the L159, the S-76C+ and the Ae 270 Ibis civil transport, the last-named (certified by EASA 12 December 2005 and FAA 24 February 2006) in a 50/50 venture with AIDC of Taiwan. Delivery of the first L159As to the Czech Air Force enabled the company to return to an operating profit. By early 2003, it had 67 firm orders and six options for the Ae 270, but no export orders had been obtained for the L159, a situation which led the Czech government in late 2003 to call for an audit of the company's affairs. It had agreed in July 2003 to cover existing bank loan repayments until

2008, but subsequently indicated that this support could be withdrawn if no sales of the L159 were obtained by the end of 2004, which they were not. Meanwhile, Aero required to repay Czech government CZK5.5 billion (USD236 million) in respect of debts cancelled in 2004. Czech government announced in May 2005 intention to offer company for public sale, but to file for bankruptcy in early 2006 if no buyer found by then. BAE Systems and Elbit were among bidders in late 2005; selection then expected by April 2006 and purchase to be finalised by mid-year, but in March 2006 privatisation progress was extended "at least until 19 July" due to intervention of a general election and re-examination of some bidders' plans for future use of company's runway. Meanwhile, agreement with Czech MoD to support L159 until 2029 was signed 8 December 2005. Revealed in late October 2006 that Czech government had authorised sale of Aero to investment company Oakfield, a subsidiary of Czech/Slovak Penta Group, for a sum of CZK2.91 billion (USD130 million). Workforce 1,644 as of 30 January 2007, but planned to reduce to about 1,200 by end of August 2007. Investment in 2006 was CZK58 million; investment of further CZK150 million planned for 2007 in effort to achieve profitability by beginning of 2008.

Under a June 2000 agreement with Sikorsky, the Aero Structures business unit is undertaking fabrication and subassembly of S-76C+ helicopter airframes (but not their dynamic systems). The agreement originally called for delivery of 15 airframes per year over a seven-year period; first set, assembled from US-built kits, was redelivered to Sikorsky at Stratford, Connecticut, in January 2001. In-country manufacture by Aero had begun by the end of that year, with the number of airframes rising annually since then: 21 completed in 2003 (bringing total to 44) and 100th on 13 March 2006. This unit also supplies gun bay doors and detail parts to Boeing for the F/A-18E/F Super Hornet and Boeing 757; detail parts and subassemblies to BAE Systems for the Boeing 767; plus detail parts to Vought Industries for the Boeing 747, and to Airbus for the A320/A340. In 2006, Alenia Aeronautica signed an agreement with Aero Vodochody for the latter to manufacture centre wing boxes for the C-27J Spartan. Production of aluminium parts for Ariane 5 spacecraft launcher began in late 2005, under subcontract to MT Aerospace of Germany.

AERO L159

TYPE: Light fighter/advanced jet trainer.

PROGRAMME: Design started late 1992; F124 turbofan selected as power plant mid-1994; Rockwell North American (now Boeing) awarded avionics contract late 1994. Development



Aero L159B tandem-seat advanced jet trainer, equipped with in-flight refuelling probe

0593109

approved by Czech government 7 April 1995, followed by production commitment later the same month and 72-aircraft production contract 4 July 1997. Two prototypes (plus two airframes for static and dynamic test) built. First (two-seat) prototype/engine demonstrator (5831) rolled out 12 June and made first flight 2 August 1997.

Second (single-seat) prototype (5832), in Czech Air Force configuration (first flight 18 August 1998) named ALCA (Advanced Light Combat Aircraft); is first with full avionics and is avionics/weapons trials aircraft. Official first flight of 5832 was 20 August; public debut during Czech International Air Fest at Hradec Králové 29 August 1998. Gun firing tests in Czech Republic followed by air-launched weapon trials in Norway in April and May 1999; nav/attack system trials August/September 1999. Weapons qualification tests at Cazaux, France, from May to July 2000.

First flight of production L159A (6001) 20 October 1999. Deliveries to CzAF due to have begun late 1999 (five aircraft, followed by 16 in 2000, 26 in 2001 and final 25 in 2002); however, first two (6006 and 6007) not delivered (to 4 Tactical Fighter Base at Caslav) until 29 December 2000, with first pilot conversion training beginning in mid-March 2001. Deliveries then rescheduled as 37 by end of 2001, 21 during 2002 and final 14 during first half of 2003. However, in May 2001, during which month aircraft evaluated by US Navy Test Pilots' School, Czech defence minister stated that CzAF will operate only 37 aircraft.

The L159A fleet (then 25 aircraft) was grounded on 14 November 2001 following incidents to two aircraft apparently due to suspected avionics malfunctions. No other significant problems had been registered by the end of 2002, but in mid-2003 Czech government stated intention to reduce CzAF inventory further. This confirmed in July 2004, when government approved reduction of operational aircraft to only 18, plus six to be held in reserve. Remaining 47 to be sold. Final L159A was delivered to Coslav AB on 3 February 2004. In-service support guaranteed until 2029 under 8 December 2005 agreement with

Czech MoD. Two further (three-year) contracts signed 27 February 2006, relating to storage of 47 surplus aircraft and spare parts delivery of remaining 24. Further contract expected by mid-2006 covering conversion of four L159As to two-seat L159Bs for the Czech Air Force.

First production L159B (6073) achieved maiden flight on 1 June 2002 and made international debut at Farnborough Air Show in following month. This aircraft, and L159A prototype, leased by Hungarian Air Force in mid-2004 as conversion trainers for MiG-29 pilots due to transfer to Saab Gripen in 2005. Four L159As being modified to L159T under contract of 26 June 2006, for re-delivery to Czech Air Force in 2007.

CURRENT VERSIONS: **L159A ALCA**: Single-seater.

Detailed description applies to L159A except where indicated.

L159B Albatros II: Tandem-seat trainer version, designed primarily for advanced and operational training; can also be configured to customer requirements from basic to lead-in fighter training, reconnaissance or ground attack. Further USD15 million invested by Boeing in July 2001 to develop software for this version.

L159T: Two-seat trainer; conversion of four CzAF L159As in 2006-07, under 26 June 2006 contract, for re-delivery by end 2007. For example (6069) due to fly in March 2007. Also to be promoted for export under designation L159BAT.

CUSTOMERS: Production lots 1 and 2 comprised five and 10 aircraft respectively, of which 12 delivered by 31 March 2001. Total 58 delivered by May 2003, but only 14 of these were then operations-capable, reportedly due to avionics and hydraulic systems problems. Deliveries completed in February 2004. Primary roles intended to be close air support, counter-insurgency, anti-ship missions, tactical reconnaissance, point air defence, air defence against slow/low-flying targets and border patrol. Prospect of exports to other countries, including Poland, to whom a Maverick-armed version was offered in late 2000, but no orders for either version by mid-2006.

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Known until 2002 as Lusus s.r.o., Aeros has 10 employees at its 700 m² (7,535 sq ft) plant. No recent evidence of activity.

AEROS UL-2000 FLAMINGO

TYPE: Side-by-side ultralight.

PROGRAMME: Entered production in 2000 and international debut at Friedrichshafen Air Show, April 2001. No recent reports of production.



UL-2000 Flamingo side-by-side ultralight (Paul Jackson)

0131725

AIRLONY

PETR LONSKÝ

CZ-277 03 Horní Počaply ĚR

Tel: (+420 608) 02 98 16

e-mail: airlony@tiscali.cz

Company's two products are available complete, or in kit form.

AIRLONY HIGHLANDER

TYPE: Tandem-seat ultralight biplane kitbuilt.

PROGRAMME: Prototype (OK-AUO 23) flying by 2005.

DESIGN FEATURES: Single-bay biplane of classic appearance; stressed for aerobatic manoeuvres where national regulations allow.

Constant-chord wings with rounded tips; rounded fin and elevator tips. Open cockpits. Wings braced by streamlined, N-type interplane struts and wires; upper wing on central cabane. Empennage braced by steel struts and wires.

Wing sections NACA 63A415 (upper) and NACA 2412 (lower).



Airlony Highlander kitbuilt biplane

1037960

FLYING CONTROLS: Conventional and manual. Interconnected ailerons on upper and lower wings. Aileron and elevator actuation by pushrods; rudder by cables.

STRUCTURE: Glass fibre fuselage; wings of conventional ribs and spars with fabric covering.

LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted, spring cantilever mainwheel legs and steerable tailwheel. Hydraulic mainwheel brakes.

POWER PLANT: One 59.7 to 89.5 kW (80 to 120 hp) piston engine driving a two-blade propeller. Fuel capacity 50 litres (13.2 US gallons; 11.0 Imp gallons).

DIMENSIONS, EXTERNAL:

Wing span 7.30 m (23 ft 11½ in)

Length overall 6.00 m (19 ft 8¼ in)

Height overall 2.15 m (7 ft 0¾ in)

AREAS:

Wings, gross 14.50 m² (156.1 sq ft)

WEIGHTS AND LOADINGS:

Weight empty (average) 220 kg (485 lb)

Max T-O weight 450 kg (992 lb)

PERFORMANCE (89.5 kW; 120 hp engine):

Max cruising speed 86 kt (160 km/h; 99 mph)

Stalling speed 36 kt (65 km/h; 41 mph)

Max rate of climb at S/L 360 m (1,180 ft)/min

Range 297 n miles (550 km; 341 miles)

AIRLONY SKYLANE

TYPE: Side-by-side ultralight kitbuilt.

PROGRAMME: Prototype (OK-IUO 11) flying by 2005.

DESIGN FEATURES: Approximately two-thirds scale replica of Cessna 182 Skylane intended for touring and glider towing. High wing braced by single streamlined strut each side; constant chord inboard; trapezoidal outboard. Sweptback fin and low-mounted tailplane.

Wing section MS(1)-313, semi-laminar. Tailplane section NACA 0012.



Prototype Airlony Skylane (R W Simpson)

1037963

AIROX

AIROX S.R.O.
Dolní Radová, CZ-463 03 Stráž nad Nisou
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e-mail: airox@airox.cz
Web: www.airox.cz
DIRECTOR: Ing. Miroslav Hajek
INFORMATION: Tomáše Valouška

Airox was formed in 1998 to build aircraft from composites materials, as well as parts for ships. In mid-2003 the company's workforce numbered 24. There has been no evidence of recent promotion or production.

AIROX F-31

TYPE: Side-by-side ultralight twin.
PROGRAMME: Public debut (F-31A) at aviation exhibition in Prague, September 2000. Engines installed and ground running underway by late 2003. No further information received.

AIRSPORT

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Fax: (+420 3) 27 59 11 84
e-mail: airsport@volny.cz
Web: www.sweb.cz/airsport

Airsport showed its current products, the Sonet and Sonáta, at Aero '05, Friedrichshafen. The company also offers a Hirth 3701-engined version of the Aviasud Petrel and another design identified as the Victori. Is also promoting DOVA Skylark, described separately.

AIRSPORT SONET

TYPE: Side-by-side ultralight.
PROGRAMME: Prototype (OK-IUL 03) first flew 2003.
DESIGN FEATURES: Low-mounted, high aspect ratio wing with dihedral and sweepback on outboard panels; sweptback, T tail; and option of nose- or tailwheel.
Wing section UAG 88-143/20.



Airsport Victori (OK-JUL 10)

1127694

FLYING CONTROLS: Conventional and manual. Ailerons on dihedral section of wing. Single-piece, horn-balanced elevator with flight-adjustable trim tab. All control gaps sealed. Flap settings -10, 0, 10 and 40°. Door-type airbrakes.

STRUCTURE: Composites.



Airport Sonet side-by-side ultralight (Paul Jackson)

1159059

LANDING GEAR: Fixed. Fuselage-mounted spring cantilever mainwheel legs. Tricycle or nosewheel; main and optional nosewheel sizes all 12x4. Cable-operated brakes.
POWER PLANT: One 47.8 kW (64.1 hp) Hirth 2706 two-cylinder piston engine driving a Jirasek two-blade, fixed-pitch propeller. Two fuel tanks in wings; total capacity 50 litres (13.2 US gallons; 11.0 Imp gallons).

DIMENSIONS, EXTERNAL:

Wing span 11.40 m (37 ft 4 3/4 in)
 Length overall 6.80 m (22 ft 3 3/4 in)
 Height overall 1.80 m (5 ft 10 3/4 in)

AREAS:

Wings, gross 9.50 m² (102.3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 253 kg (558 lb)
 Max T-O weight 450 kg (992 lb)

PERFORMANCE:

Normal cruising speed (−10° flap) 76 kt (140 km/h; 87 mph)
 Stalling speed flaps down 35 kt (64 km/h; 40 mph)
 Endurance 3 h

AIRSPORT SONÁTA

TYPE: Tandem-seat ultralight motor glider.

PROGRAMME: Derivative of Aerosport Sonet with increased wing span; narrow track, retractable mainwheels; Z-type, retractable propeller; and tandem seating. Prototype first flew September 2004.

Description generally as of Sonet, except the following.

DESIGN FEATURES: Constant-chord wing centre-section; two-stage sweepback with progressively increased dihedral; rounded wingtips.

FLYING CONTROLS: Large ailerons mid-wing. Flap settings −10, 0, 10°.

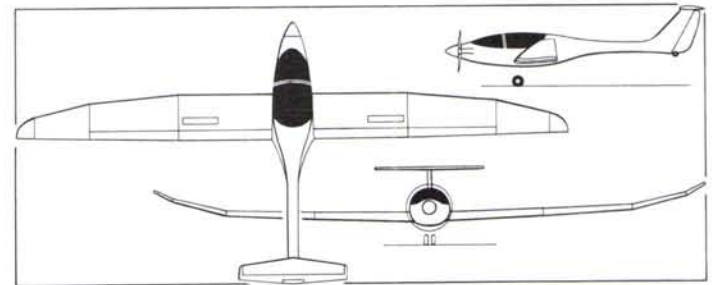
LANDING GEAR: Tailwheel type. Fixed, solid tailwheel; narrow track mainwheels retract rearwards on cantilever legs with compressed rubber shock-absorbers. Fixed outrigger wheels.

POWER PLANT: One 36.8 kW (49.3 hp) Hirth F23 two-cylinder piston engine driving a Jirasek two-blade, fixed-pitch propeller. Two fuel tanks in wings; total capacity 52 litres (13.7 US gallons; 11.4 Imp gallons).



Airport Sonáta motor glider (Paul Jackson)

1127786



Airport Sonáta (Hirth F23 two-cylinder engine) (James Goulding)

1127533

DIMENSIONS, EXTERNAL:

Wing span 15.05 m (49 ft 4 1/2 in)
 Length overall 6.80 m (22 ft 3 3/4 in)
 Height overall 1.45 m (4 ft 9 in)

AREAS:

Wings, gross 14.30 m² (153.9 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 278 kg (613 lb)
 Max T-O weight 450 kg (992 lb)

PERFORMANCE (powered):

Never-exceed speed (VNE) 106 kt (198 km/h; 123 mph)
 Stalling speed 30 kt (55 km/h; 35 mph)
 Max rate of climb at S/L 120 m (394 ft)/min

PERFORMANCE (unpowered):

Stalling speed, flaps down 36 kt (65 km/h; 41 mph)
 Best glide ratio 35
 Min rate of sink 0.80 m (2.62 ft)/s

ATEC**ATEC V.O.S**

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e-mail: sales@atecvos.cz

Web: www.atecvos.cz

PRODUCTION DIRECTOR: Petr Volejník

SALES DIRECTOR: Jan Franěk

ATEC was formed in 1992 to develop, manufacture and sell ultralight aircraft. Its most recent product, the single-seat Solo, was launched in 2005. In late 2005, the company employed 20 in its 800 m² (8,610 sq ft) factory.

ATEC ZEPHYR and FAETA

TYPE: Side-by-side ultralight/kitbuilt.

PROGRAMME: Prototype Zephyr (OK-CUA 01). First flown 1996; production started the following year.

CURRENT VERSIONS: **Zephyr:** Original version, no longer available; 10.60 m (34 ft 9 1/4 in) wing span and 59.6 kW (79.9 hp) Rotax 912 UL engine.

Zephyr 2000: Introduced April 2001; C suffix indicates change to new shape all-carbon composites fuselage construction; shorter wing and tail spans.

Description below applies to Zephyr 2000C.

ATEC 212 Solo: Single-seat version. Prototype (OK-FUH 01) made initial flight 29 October 2000. Not proceeded with.

ATEC 321 Faeta: Maiden (OK-IUG 15) flight in February 2003; introduced at Aero '03, Friedrichshafen, April 2003. As Zephyr, but wholly of carbon fibre, including new, tapered



ATEC Zephyr 2000 being promoted for US LSA category (Paul Jackson)

1159060



ATEC 321 Faeta carbon fibre ultralight (Paul Jackson)

1121665

wing with constant sweepback, differently proportioned ailerons and slotted flaps. Two-blade ground adjustable Fiti propeller and ballistic parachute. Generally as Zephyr unless otherwise indicated.

CUSTOMERS: Over 160 all versions (including some 50 kits) built and sold by April 2006. Exported to Australia, Belgium, Canada, China, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Lithuania, Netherlands, New Zealand, Norway, Portugal, South Africa, Spain, Sweden, Ukraine and the US.

COSTS: Zephyr 2000: EUR44,900 with Rotax 912 UL; EUR46,900 with Rotax 912 ULS (2005); Faeta: EUR52,500 with Rotax 912 UL; EUR54,500 with Rotax 912 ULS (2005) all flyaway, excluding tax. Zephyr kit (excluding engine) EUR27,790; fast-build kit EUR22,990 extra (2006).

DESIGN FEATURES: Low-wing monoplane with T tail. Wing section UA-2 laminar flow on Zephyr 2000 and SM 701 on Faeta. Meets LSA requirements where 550 kg (1,212 lb) MTOW acceptable.

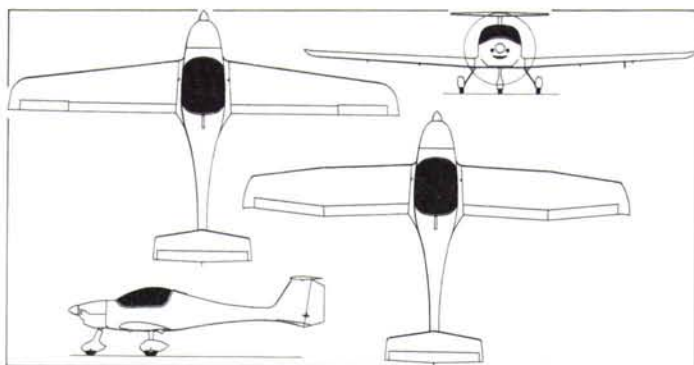
FLYING CONTROLS: Conventional and manual; spring trim. Electric flaps and elevator trim optional. Dual controls.

STRUCTURE: **Zephyr 2000:** Fuselage of carbon reinforced by wooden and hardened foam bulkheads; wing leading-edge of glass fibre sandwich; horizontal tail, wingtips, elevator, rudder, mainwheel legs and engine cowlings of glass fibre composites. Laminated hardwood wing main spar. Chromoly steel wing fittings; welded chromoly wing centre-section. Wing and horizontal tail trailing-edge of fabric-covered wood.

Faeta: Fuselage as Zephyr, with carbon, hardened foam and honeycomb sandwich reinforcements. Carbon sandwich wing with laminated hardwood spar; fittings and centre-section as Zephyr. Honeycomb sandwich control surfaces.

LANDING GEAR: Tricycle type, fixed. Fuselage-mounted cantilever mainwheel legs. Aerodynamic composites nosewheel leg and integral wheel fairing. Castoring nosewheel. Tyres sizes 380x100 (main), 300x100 (nose); Faeta has 350x120 main tyres. Hydraulic disc brakes. Speed fairings on all three wheels.

POWER PLANT: **Zephyr 2000:** One 59.6 kW (79.9 hp) Rotax 912 UL or 73.5 kW (98.6 hp) Rotax 912 ULS flat-four engine; Fiti two- or three-blade ground-adjustable pitch propeller;



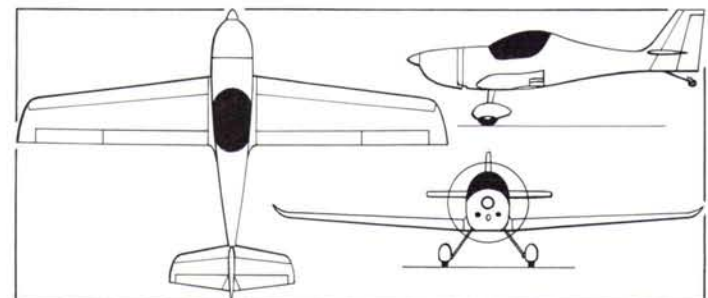
ATEC Faeta general arrangement, with extra plan view (lower) of Zephyr

0547522



ATEC 212 Solo at its public debut (Paul Jackson)

1159061



ATEC 212 Solo single-seat ultralight (James Goulding)

1151425

optional Fiti two- or three-blade in-flight-adjustable propeller with choice of mechanical or electric control. Rotax 582 UL engine optional. Fuel capacity 60 litres (15.9 US gallons; 13.2 Imp gallons) standard, 80 litres (21.1 US gallons; 17.6 Imp gallons) optional.

Faeta: Rotax 912 UL or 912 ULS. Fuel capacity 70 litres (18.4 US gallons; 15.4 Imp gallons).

ACCOMMODATION: Pilot and passenger side by side under one-piece canopy.

EQUIPMENT: Optional ballistic parachute system.

DIMENSIONS, EXTERNAL:

Wing span	9.60 m (31 ft 6 in)
Length overall	6.20 m (20 ft 4 in)
Height overall	2.00 m (6 ft 6 3/4 in)

AREAS:

Wings, gross	10.10 m ² (108.7 sq ft)
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WEIGHTS AND LOADINGS (912 ULS engine; A: Zephyr. B: Faeta):

Weight empty: A	275 kg (606 lb)
B	280 kg (617 lb)
Max T-O weight: standard	450 kg (992 lb)
with ballistic parachute	472.5 kg (1,041 lb)
where allowed	550 kg (1,212 lb)

PERFORMANCE:

Max level speed: A	132 kt (245 km/h; 152 mph)
B	138 kt (255 km/h; 158 mph)
Max cruising speed: A	116 kt (215 km/h; 133 mph)
B	124 kt (230 km/h; 143 mph)
Stalling speed, flaps down: A	36 kt (65 km/h; 41 mph)
B	33 kt (60 km/h; 38 mph)
Max rate of climb at S/L: A	390 m (1,280 ft)/min
B	420 m (1,378 ft)/min
T-O run	120 m (395 ft)
Landing run	200 m (660 ft)
Range: standard fuel	432 n miles (800 km; 497 miles)
optional fuel	594 n miles (1,100 km; 683 miles)
g limits: A	+4/-2
B	+5/-2

ATEC 212 SOLO

TYPE: Single-seat ultralight.

PROGRAMME: Prototype (OK-KUG 32) first flew 3 April 2005; public debut at Aero '05, Friedrichshafen, 21 to 24 April 2005.

DESIGN FEATURES: Single-seat derivative of ATEC 321 Faeta, incorporating wing of company's Faeta. Wing section SM 701.

FLYING CONTROLS: Conventional and manual. Elevator and aileron actuation by pushrods; rudder by cables. Electric trim tab in elevator. Three-position, electrically-actuated, slotted flaps.

STRUCTURE: Tubular steel cockpit cage; carbon composites fuselage, reinforced with carbon bars and sandwich bulkheads. Integral empennage of carbon fibre with Nomex honeycomb. Wings constructed around laminated beech spar and carbon sandwich covering; carbon fibre ailerons.

LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted, spring composites cantilever mainwheel legs with wheel fairings, 350x120 wheels and hydraulic disc brakes. Solid tailwheel.

POWER PLANT: One 48.0 kW (64.4 hp) Rotax 582 DCDI two-cylinder, liquid-cooled two-stroke. Fiti ground-adjustable pitch, two-blade propeller. Fuel tank beneath pilot, capacity 50 litres (13.2 US gallons; 11.0 Imp gallons).

DIMENSIONS, EXTERNAL:

Wing span	7.48 m (24 ft 6 1/2 in)
Length overall	5.26 m (17 ft 3 in)
Height overall	1.53 m (5 ft 0 1/4 in)

AREAS:

Wings, gross	7.27 m ² (78.3 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	200 kg (441 lb)
Max T-O weight	300 kg (661 lb)

PERFORMANCE:

Never-exceed speed (VNE)	157 kt (291 km/h; 180 mph)
Max level speed	146 kt (270 km/h; 168 mph)
Stalling speed: flaps up	42 kt (77 km/h; 48 mph)
flaps down	35 kt (64 km/h; 40 mph)
Max rate of climb at S/L	420 m (1,378 ft)/min
Range with max fuel	351 n miles (650 km; 403 miles)
g limits	+6/-3

CZAW

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In 1997 Zenair Ltd of Canada formed a joint venture with CZAW, established earlier that year, for manufacture in the Czech Republic of its STOL CH 701 and Zodiac CH 601 series of light aircraft. First Czech components were manufactured in 1998; by September 2003, over 500 aircraft had been produced. The STOL CH 801 and CH 2000 are now also available from CZAW. Workforce in 2005 was 130.

CZAW offers the CH 601, 701 and 801 in three different stages of completion: as a standard kit; as a factory-jigged, fast-build kit; and in full flyaway form with Rotax 912 engine, avionics, instruments and two-tone paint finish. A total of 85 CH 701s, with options for 48 more, was ordered by the Indian National Cadet Corps in late 2000 for the training of Indian Air Force pilots. Development was completed in late 1998 of a modified CH 701 for ULV agricultural applications. A Zodiac floatplane, flown by CZAW's CEO, won the 1999, 2001 and 2003 Schneider Cup seaplane races. Additionally, CZAW is European agent for the AMD CH 2000 and also offers upgraded and refurbished Lake Buccaneer and Renegade 2 amphibians.

A new design, the Mermaid, was unveiled at Sun 'n' Fun in April 2004; it was followed in 2005 by the Parrot and in 2006 by the Sport Cruiser, giving CZAW three aircraft optimised for the US LSA category.

CZAW produces a complete line of wheeled and non-wheeled aircraft floats, with displacements ranging from 250 to 1,000 kg (551 to 2,205 lb), suitable for such aircraft as the GlaStar, Kitfox, Zenair and Van's types. 'Jump-start' wings, ailerons, flaps and tail surfaces for the GlaStar kitplane are also manufactured.

CZAW MERMAID

TYPE: Two-seat amphibian ultralight/kitbuilt.

PROGRAMME: First flight (OK-JUR 99) 11 March 2004; initially known as CZAW Lake Sport Mermaid. Following preliminary testing, shipped to Lakeland, Florida, for public debut at Sun 'n' Fun, 13-19 April 2004. Flight testing (reregistered N599MM) was due for completion by end of 2004 and revealed need for several modifications, some of which applied to prototype, including cruciform empennage.

These embodied in first production aircraft, flown at Borsice on 3 May 2005 and transferred to US for exhibition at AirVenture, Oshkosh, July 2005. Changes included new wing aerofoil section; increased wing span, with upturned tips; wing incidence increased from 1 to 3°; 40 per cent larger ailerons; 5 cm (2 in) deeper hull; step moved 20 cm (8 in) to rear; rear fuselage angle raised 3°; vortex generators around rear of canopy; fin extension above tailplane; and four- (replacing three-) blade propeller.

LSA approval received February 2006; LSA exemption for retractable landing gear granted 4 April 2006.

CUSTOMERS: More than 30 sold by April 2004 and over 100 by late 2005. Deliveries were scheduled to begin in first quarter of 2005, but were delayed by need for extensive modifications to design.

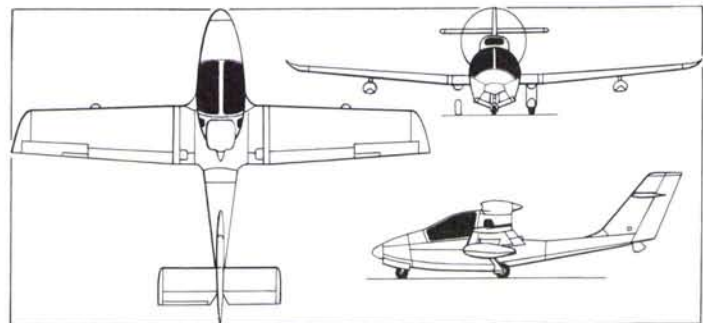
COSTS: USD85,000 E-LSA or USD87,500 S-LSA Rotax engine; USD88,500 E-LSA or USD91,000 S-LSA Jabiru engine; all flyaway. Kit minus engine USD45,500 (Experimental). (All 2006.)

DESIGN FEATURES: Intended as roomy, low-cost amphibian designed specifically to meet US LSA criteria and with useful range and dual controls.



Water trials of first production CZAW Mermaid

1158015



CZAW Lake Sport Mermaid (James Goulding)

1158034

Mid-wing configuration; constant-chord wings with stabilising floats at half span; cruciform empennage. Wings removable to reduce width of airframe for storage or transport; folding wing option to be added. Pusher propeller above and behind cockpit; retractable water rudder at rear of single-step hull. Five hull compartments, each watertight and with bilge pump socket in port wing, adjacent to cockpit. Quoted build time 400 hours. Dihedral 5° (except centre-section); incidence 3°.

FLYING CONTROLS: Conventional and manual. Flight-adjustable trim tabs in elevator and starboard aileron. Fowler flaps: deflections 20 and 40°. Aileron trim optional. Control surface deflections: ailerons +28/-18°; elevator ±25°; rudder ±30°.

STRUCTURE: Aluminium alloy throughout, except for rubber nosecone. Full zinc chromate coating.

LANDING GEAR: Tricycle type; retractable. Mainwheels retract hydraulically (manual; electro-hydraulic option) rearward into wing, tread protruding through port in upper wing surface and visible from cockpit rear quarterlights. Nosewheel retracts forward and is steerable. Mainwheels size 14x4 with hydraulic brakes; nosewheel 4.00x4. Rubber-in-compression shock-absorbers throughout, with twin units on each mainwheel leg. Tail bumper. Retractable water rudder.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS flat-four driving a Warp Drive three-blade, ground-adjustable pitch, carbon fibre propeller. Optionally, one 84.5 kW (113.3 hp) Rotax 914. Trial 89 kW (120 hp) Jabiru 3300 installation completed for trials in early 2006.

Fuel tanks in wing leading-edge, total capacity 100 litres (26.4 US gallons; 22.0 Imp gallons).

ACCOMMODATION: Two persons, side by side, beneath forward-hinged, single-piece canopy; dual controls. Baggage space to rear, above and below main spar.

AVIONICS: VFR instrumentation standard.

EQUIPMENT: Portable, hand-operated bilge pump. Optional BRS ballistic recovery parachute and landing light in starboard wing leading-edge.

DIMENSIONS, EXTERNAL:

Wing span	10.16 m (33 ft 4 in)
Wing aspect ratio	7.8
Length overall	7.635 m (25 ft 0½ in)
Height overall	2.61 m (8 ft 6¾ in)

Tailplane span	3.02 m (9 ft 11 in)
Wheel track	1.83 m (6 ft 0 in)
Propeller diameter	1.50 m (4 ft 11 in)
DIMENSIONS, INTERNAL:	
Cabin max width	1.17 m (3 ft 10 in)
Baggage volume	0.23 m³ (8.1 cu ft)
AREAS:	
Wings, gross	12.50 m² (134.5 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	377 kg (832 lb)
Max T-O weight	639 kg (1,410 lb)
Max wing loading	51.1 kg/m² (10.47 lb/sq ft)
Max power loading	8.70 kg/kW (14.30 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	135 kt (250 km/h; 155 mph)
Cruising speed (design)	107 kt (198 km/h; 123 mph)
Stalling speed: flaps up	44 kt (80 km/h; 50 mph)
flaps down	38 kt (71 km/h; 44 mph)
Max rate of climb at S/L	300 m (984 ft)/min
T-O run: on land	137 m (450 ft)
on water	229 m (755 ft)
Landing run: on land, water	152 m (500 ft)
Range	432 n miles (800 km; 497 miles)
Endurance	4 h 30 min
g limits	+4/-2

CZAW PARROT

TYPE: Two-seat lightplane; side-by-side kitbuilt.

PROGRAMME: Prototype first flew (OK-KUR 20) 15 June 2005, then immediately shipped to US (N599PP assigned) for further trials and debut at AirVenture, Oshkosh, 25 to 31 July 2005. Initial deliveries (beginning N595PP) then scheduled for second quarter of 2006. LSA approval granted January 2006.

CURRENT VERSIONS: LSA: As described.

Experimental: Proposed version for higher weight category; 93 kW (125 hp) or similar engine; cruising speed 130 kt (241 km/h; 150 mph); range unaltered.

COSTS: USD75,500 flyaway with Rotax engine or USD78,500 with Jabiru; USD39,500 fast-build kit, plus USD20,890 for full Rotax engine kit. (All 2006.)

DESIGN FEATURES: Optimised for US LSA category, but also suitable for Experimental category. Crew envisaged as each weighing 113 kg (250 lb) and 1.88 m (6 ft 2 in) tall.

High wing immediately behind cockpit; conical section rear fuselage with sweptback fin and low tailplane with sweptback leading-edge.

Wing sweepforward 7° at main spar; 5° at leading-edge.

FLYING CONTROLS: Conventional and manual. Horn-balanced rudder; single-piece elevator; flight-adjustable trim tabs in elevator and port aileron. Electrically actuated flaps.

STRUCTURE: Generally of riveted aluminium.

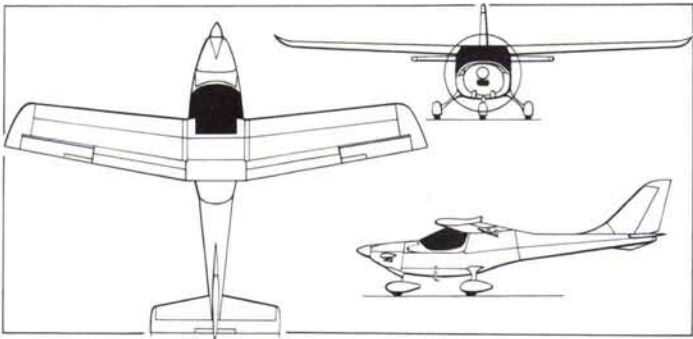
LANDING GEAR: Tricycle type; fixed. All tyres 5.00-5. Steerable nosewheel. Optional wheel fairings. Optional floats.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS flat-four driving a three-blade, carbon fibre, ground-adjustable pitch propeller. Optionally, one 89 kW (120 hp) Jabiru 3300



CZAW Parrot first production aircraft

1158017



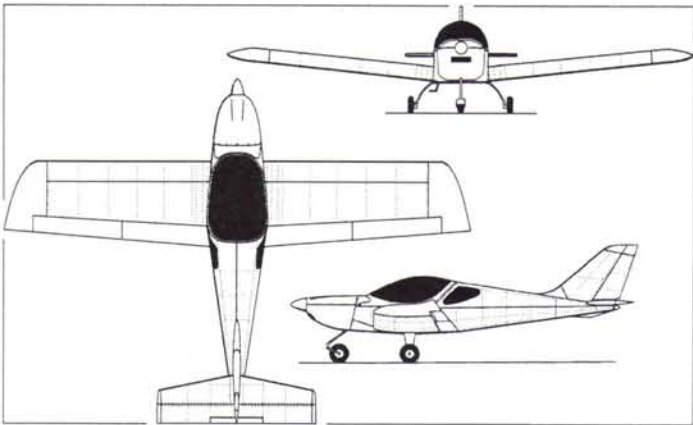
CZAW Parrot, optimised for US LSA category (James Goulding) 1151448

flat-six; and choice of two-blade manual or electric in-flight adjustable pitch propellers. Two wing fuel tanks, standard combined capacity 100 litres (26.4 US gallons; 22.0 Imp gallons). Optional long range wing tanks.
ACCOMMODATION: Two persons side-by-side beneath forward-hinged, single-piece canopy/windscreen. Large baggage area behind seats.
EQUIPMENT: Optional BRS ballistic recovery parachute.

DIMENSIONS, EXTERNAL:	
Wing span	9.495 m (31 ft 1¼ in)
Length overall	7.10 m (23 ft 3½ in)
Height overall	2.58 m (8 ft 5½ in)
Tailplane span	2.90 m (9 ft 6¼ in)
Wheel track	2.04 m (6 ft 8¼ in)
Wheelbase	1.65 m (5 ft 5 in)
Propeller diameter	1.77 m (5 ft 9¾ in)
DIMENSIONS, INTERNAL:	
Cabin max width	1.15 m (3 ft 9¼ in)
Baggage volume	0.62 m³ (22.0 cu ft)
AREAS:	
Wings, gross	11.40 m² (122.7 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	360 kg (794 lb)
Max T-O weight	598 kg (1,320 lb)
PERFORMANCE:	
Never-exceed speed (VNE)	135 kt (250 km/h; 155 mph)
Cruising speed at 75% power	99 kt (185 km/h; 115 mph)
Stalling speed: flaps up	34 kt (63 km/h; 40 mph)
flaps down	31 kt (56 km/h; 35 mph)
Max rate of climb at S/L	480 m (1,575 ft)/min
T-O run	120 m (394 ft)
T-O to 15 m (50 ft)	225 m (740 ft)
Landing run	120 m (394 ft)
Range at cruising speed	479 n miles (888 km; 551 miles)
Endurance	4 h 30 min
g limits	+6/-4

CZAW SPORT CRUISER

TYPE: Side-by-side lightplane/kitbuilt.
PROGRAMME: Announced January 2006 when prototype believed already flying; LSA approval granted March 2006; public debut at Sun 'n' Fun, Lakeland, Florida, 4 to 10 April 2006 when US demonstrator (N595SC c/n 002) displayed flying and sixth aircraft statically.
COSTS: USD65,000 flyaway; kit USD32,000, excluding engine (2006).
DESIGN FEATURES: Optimised for US S-LSA criteria and as Experimental homebuilt. Low wing with unswept leading edge and sweptforward trailing edge; sweptback fin with small fillet; and low tailplane.
FLYING CONTROLS: Conventional and manual. Balanced ailerons with tab in starboard unit; single-piece elevator with large trim/anti-balance tab; full-height, balanced rudder. Plain flaps.
STRUCTURE: Generally of metal, with composites wingtips.



CZAW Sport Cruiser general arrangement 1158033

LANDING GEAR: Nosewheel type; fixed. Fuselage-mounted, cantilever spring mainwheel legs with hydraulic brakes; trailing link, castoring nosewheel on metal tube cantilever leg; all tyres 4.00-6.
POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS flat-four driving a three-blade, carbon fibre, ground-adjustable pitch propeller as standard. Options include 89 kW (120 hp) Jabiru 3300 flat-six; and Woodcomp three-blade fixed-pitch wooden propeller, ground-adjustable, composites Sensenich two-blade and Sport Prop three-blade propellers and in-flight adjustable equivalents. Fuel in two wing tanks, combined capacity 114 litres (30.1 US gallons; 25.1 Imp gallons).
ACCOMMODATION: Two persons side by side beneath single-piece, forward-hinged canopy/windscreen; small side windows.
SYSTEMS: Electrical system; 12 V.
AVIONICS: Basic flight instruments standard. Communications and navigation options to customer's requirements.

DIMENSIONS, EXTERNAL:	
Wing span	8.50 m (27 ft 10¾ in)
Wing aspect ratio	6.1
Length overall	7.00 m (22 ft 11½ in)
DIMENSIONS, INTERNAL:	
Cabin max width	1.14 m (3 ft 8¾ in)
AREAS:	
Wings, gross	11.80 m² (127.0 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty (Rotax 912 ULS)	307 kg (677 lb)
Max T-O weight	598 kg (1,320 lb)
Max wing loading	50.7 kg/m² (10.39 lb/sq ft)
Max power loading	8.15 kg/kW (13.39 lb/hp)
PERFORMANCE (Rotax 912 ULS engine):	
Never-exceed speed (VNE)	139 kt (258 km/h; 160 mph)
Cruising speed at 75% power	108 kt (201 km/h; 125 mph)
Stalling speed: flaps up	33 kt (61 km/h; 38 mph)
flaps down	30 kt (55 km/h; 35 mph)
Max rate of climb at S/L	360 m (1,181 ft)/min
T-O run	105 m (345 ft)
T-O to 15 m (50 ft)	210 m (690 ft)
Landing run	120 m (395 ft)
Range at cruising speed	478 n miles (886 km; 550 miles)
Endurance	5 h

CZAW (ZENAIR) CH 701-AG STOL

TYPE: Agricultural sprayer.
PROGRAMME: Developed by CZAW following cessation of Zenith production of a dedicated agricultural version. The CH 701-SP with 500 kg (1,100 lb) maximum take-off weight has been added to the range, while the standard CH 701 is also available.
COSTS: CH 701 kit USD12,980, ready to fly USD40,500; CH 701-AG USD50,000 ready-to-fly (all 2004).



Demonstration flight by CZAW Sport Cruiser at its public debut in April 2006 (Paul Jackson) 1158018

DESIGN FEATURES: STOL performance, plus ULV crop treatment system optimised for low cost and precise application.

Differences from basic, US-fabricated CH 701 as follows:

EQUIPMENT: Spray Miser ULV crop treatment system, comprising 113.6 litre (30.0 US gallon; 25.0 Imp gallon) belly tank and 12 wind-driven rotary atomisers with controlled droplet application. Hydraulic nozzles produce droplet sizes varying from 1 to 500 microns in size. Electrically powered pump (12 V DC), with remotely controllable on/off switch, can deliver liquid at up to 30.3 litres (8.0 US gallons; 6.7 Imp gallons)/min. Tank has emergency dump facility.

DF

DIRECT FLY

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Direct Fly is marketing several versions of its Alto in Italy via local Aviomarche company.

DF ALTO

TYPE: Two-seat lightplane; side-by-side ultralight/kitbuilt.

PROGRAMME: Prototype, with tailwheel and Jabiru engine, registered I-8039; nosewheel prototype first flew 2 September 2006.

CURRENT VERSIONS: **Alto 912 UL TW**: Rotax 912 UL engine and tailwheel landing gear.

Alto 912 UL TG: Rotax 912 UL engine and tricycle landing gear.

Alto 912 ULS TW/TG: Rotax 912 ULS and landing gear options.

Alto 2200 TW/TG: Jabiru 2200 and landing gear options.

Alto 3300 TW/TG: Jabiru 3300 and landing gear options.

DESIGN FEATURES: Low-mounted, constant-chord wing and tailplane; sweptback fin.

Quoted kit build time 160 hours.

FLYING CONTROLS: Conventional and manual. Flaps.



DF Alto nosewheel version

1158841



Prototype DF Alto, with tailwheel and Jabiru engine

1158840

WEIGHTS AND LOADINGS:

Weight empty, equipped 270 kg (595 lb)

Max T-O weight 450 kg (992 lb)

PERFORMANCE:

Application speed range 39–65 kt (72–121 km/h; 45–75 mph)

Max rate of climb at S/L 305 m (1,000 ft)/min

Swath width 9.1–30.5 m (30–100 ft)

Range 217 n miles (402 km; 250 miles)

STRUCTURE: Metal throughout. Rectangular fuselage cross-section, rounded above and connected with reinforcing struts. Glass fibre engine cowling.

LANDING GEAR: Fixed. Nosewheel or tailwheel type. Fuselage-mounted, spring composites cantilever mainwheel legs. Mainwheels and optional nosewheel size 400x120.

POWER PLANT: Engine options comprise 58.8 kW (78.9 hp) Rotax 912 UL; 73.5 kW (98.6 hp) Rotax 912 ULS; 74.6 kW (100 hp) Jabiru 2200; and 89.5 kW (120 hp) Jabiru 3300.

Three-blade propeller on geared Rotax 912 ULS version; two-blade propeller on Jabiru 3300 version. Fuel capacity 105 litres (27.7 US gallons; 23.1 Imp gallons) in all versions.

ACCOMMODATION: Two persons, side by side beneath single-piece canopy/windscreen.

EQUIPMENT: Optional ballistic recovery parachute.

DIMENSIONS, EXTERNAL:

Wing span 7.77 m (25 ft 6 in)

Wing aspect ratio 6.0

Length overall 6.50 m (21 ft 4 in)

Height overall 2.20 m (7 ft 2 1/4 in)

DIMENSIONS, INTERNAL:

Cockpit max width 1.06 m (3 ft 5 3/4 in)

AREAS:

Wings, gross 10.14 m² (109.1 sq ft)

WEIGHTS AND LOADINGS:

Weight empty (912 ULS) 295 kg (650 lb)

Max T-O weight: Ultralight 450 kg (992 lb)

Ultralight with BRS 472.5 kg (1,041 lb)

LSA 598 kg (1,320 lb)

Max wing loading, LSA 59.1 kg/m² (12.10 lb/sq ft)

Max power loading, LSA, J 3300 6.70 kg/kW (11.00 lb/hp)

PERFORMANCE (Rotax 912 ULS):

Never-exceed speed (VNE) 145 kt (270 km/h; 167 mph)

Max level speed 132 kt (245 km/h; 152 mph)

Cruising speed at 75% power 97 kt (180 km/h; 112 mph)

Stalling speed, flaps down:

with BRS 36 kt (65 km/h; 41 mph)

LSA 41 kt (76 km/h; 48 mph)

Max rate of climb at S/L: with BRS 312 m (1,024 ft)/min

LSA 282 m (925 ft)/min

T-O run 85 m (280 ft)

Landing run, without braking 150 m (495 ft)

g limits: with BRS +5.2/–2.6

LSA +4.0/–2.0

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TYPE: Two-seat lightplane; side-by-side ultralight.

PROGRAMME: Designed and built in Canada as private project by Dr David Marsden, professor emeritus of Alberta University, whose previous aircraft have included Bushmaster, ARV Griffin, Westwind (ultralight), Gold Finch, and Gemini and Sigma sailplanes. Design began January 1999; prototype Skylark CL3 (C-GFMZ) first flew 10 March 2000; shortly after, tested with single, then double winglets on each tip; exhibited at AirVenture, Oshkosh, July 2001; reverted to single winglet, as shown one year later.

Dova obtained production rights in 2002. Czech ultralight type certificate awarded 19 October 2005. North American marketing by Sportsplanes of Draper, Utah, began at Sun 'n' Fun, Lakeland, Florida, April 2006.

CURRENT VERSIONS: **Ultralight:** Available to various nationalities' ultralight max T-O weights.

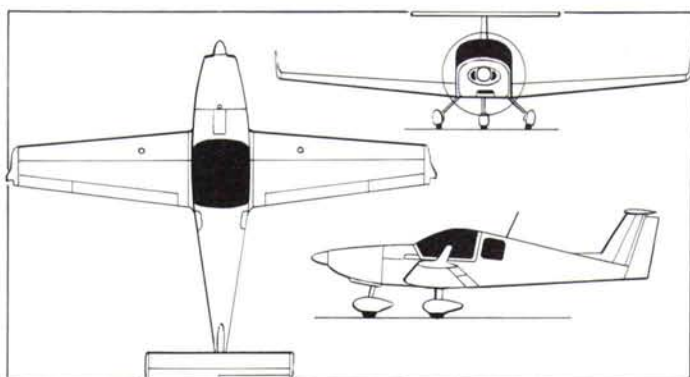
LSA: Light Sport Aircraft to US specification and weight.

CUSTOMERS: Several produced in Czech Republic prior to North American launch.

DESIGN FEATURES: Low, tapered wing with winglets; sweptback fin and T tail. Prototype had Frise flaperons deflecting 20° for landing and up 10° for cruising.

Laminar flow wing of IARV 419 section designed by Dr Marsden for docile stall characteristics and continued good performance despite insect or rain contamination; dihedral 5°.

FLYING CONTROLS: Conventional and manual. Balanced control surfaces; trim tab in starboard side of elevator. Actuation by cables (rudder) and pushrods; electric trim tab. Plain flaps deflect 0, 10 and 40°.

DOVA DV-1 Skylark (*James Goulding*)

1158781

STRUCTURE: Generally 6061-T6 aluminium structure with 2024-T3 control surfaces, plus composites winglets, engine cowling and mainwheel legs. Wing has channel-type spar at 38 per cent chord and six stamped ribs; bolted to fuselage carry-through spar. Fuselage of semi-monocoque, with three formers aft of cockpit.

LANDING GEAR: Tricycle type; fixed. Hydraulic mainwheel brakes. Wheel fairings.

POWER PLANT: Typically one 73.5 kW (98.6 hp) Rotax 912S liquid-cooled flat-four driving a Kaspar, three-blade, ground-adjustable pitch propeller. Alternatively, 59.6 kW (79.9 hp) Rotax 912, 84.5 kW (113.3 hp) Rotax 914, or 72.3 kW (96.6 hp) BMW R1100. Fuel in two wing tanks, combined capacity 90 litres (23.8 US gallons; 19.8 Imp gallons).

ACCOMMODATION: Two persons, side by side, beneath single-piece, forward-hinged canopy/windscreen; rear window each side. Sliding canopy for LSA version.

EQUIPMENT: Galaxy GRS 450 B-2 ballistic recovery parachute.

DIMENSIONS, EXTERNAL:

Wing span over winglets	8.165 m (26 ft 9½ in)
Wing chord: at root	1.485 m (4 ft 10½ in)
at tip	0.775 m (2 ft 6½ in)
Wing aspect ratio	7.1
Length overall	6.625 m (21 ft 8¾ in)
Height overall	2.29 m (7 ft 6¼ in)
Tailplane span	2.865 m (9 ft 4¾ in)
Wheel track	1.755 m (5 ft 9 in)
Wheelbase	1.365 m (4 ft 5¾ in)
Propeller diameter	1.62 m (5 ft 3¾ in)
Propeller ground clearance	0.28 m (11 in)

DIMENSIONS, INTERNAL:

Cabin max width	1.09 m (3 ft 7 in)
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AREAS:

Wings, gross	9.44 m ² (101.6 sq ft)
Vertical tail surface	1.47 m ² (15.82 sq ft)
Horizontal tail surface	1.02 m ² (10.98 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	280 kg (617 lb)
Max baggage weight	25 kg (55 lb)
Max T-O weight: UL	450 kg (992 lb)
UL with parachute	472.5 kg (1,041 lb)
AULA	550 kg (1,212 lb)
LSA	598 kg (1,320 lb)
Max wing loading, LSA	63.3 kg/m ² (12.99 lb/sq ft)
Max power loading, LSA, Rotax 912S	8.15 kg/kW (13.39 lb/hp)

PERFORMANCE (Rotax 912S engine):

Never-exceed speed (VNE)	151 kt (280 km/h; 174 mph)
Max level speed	130 kt (240 km/h; 149 mph)
Cruising speed at 75 % power	113 kt (210 km/h; 130 mph)
Stalling speed: flaps up	43 kt (79 km/h; 50 mph)
flaps down	35 kt (64 km/h; 40 mph)
Max rate of climb at S/L	480 m (1,574 ft)/min
Service ceiling	3,650 m (11,980 ft)
T-O run	152 m (500 ft)
Landing run	162 m (530 ft)
Range at 60% power, with 45 min reserves	540 n miles (1,000 km; 621 miles)
g limits: UL	+4/-2
LSA	+6/-3



DOVA DV-1 Skylark operating as a Czech ultralight

1128994

EVEKTOR

EVEKTOR-AEROTECHNIK AS

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The Evtor Group aircraft design office (workforce 150 in 1999) was formed in 1991, a major part of its initial work consisting of contribution to the designs of the L 159 and Ae 270 Ibis under contract to Aero Vodochody. On 2 February 1996 it acquired a 100 per cent

shareholding in Aerotechnik CZ, and in 1996–97 the two companies (now a single joint-stock company) developed and delivered preseries and test front fuselage components of the L 159 to Aero.

Aerotechnik was formed on 1 January 1970, originally as an enterprise of the former Czechoslovak defence organisation Svazarm. Its first aircraft programmes involved single- and two-seat rotorcraft such as the A-70, later diversifying into overhaul and maintenance of a range of Czech general aviation aircraft, including the Zlin family, L-13 Vivat and L-60 Brigadyr. Two facilities, at Kunovice and Moravská Třebová, had a combined floor space of 7,340 m² (79,000 sq ft). The combined Evektor-Aerotechnik workforce totalled 400 in mid-2003.

In 1996, Aerotechnik produced kits for the P 220 UL Koala development of the Pottier P 220 S Koala, powered by its own Mikron III engine of which 35 aircraft and seven kits were produced by 1999, at which time the design was further developed into the EV-97 Eurostar with a Rotax 912 UL engine, and became the first aeroplane to bear the Evektor name. A VLA version of the Eurostar, the Harmony, followed in 2001, and an LSA version, the SportStar, in 2003.

During 1999–2000, Evektor-Aerotechnik assisted in early stages of the Wolfsberg Raven 257 programme, including assembly of the prototype; this aircraft was subsequently transferred to Wolfsberg Letov. A separate joint venture was formed in October 1999 with GAIC of China, leading to establishment in June 2000 of Guizhou Evektor Aircraft Corporation for local production, sales and support of Evektor-Aerotechnik aircraft in that country. The first EV-97 CKD kit for Chinese assembly was delivered in August 2000. This arrangement superseded that previously agreed for Guizhou to become a licensed production centre for the Raven 257. Chinese EV-97 programme has been directed towards a UAV version, as revealed in early 2006.

In 2001, Evektor-Aerotechnik, in collaboration with the Aerospace Research Centre and Institute of Aerospace Engineering of Brno Technical University, began development of the VUT 100 Cobra which first flew on 11 November 2004. This was followed in 2003 by the EV-55 project, for which a first flight in mid-2007 is projected.

As well as aircraft design, Evektor also produces styling and stress analysis to the automotive and light engineering industries, including Stihl chainsaws.

EVEKTOR EV-97 TEAMEUROSTAR

TYPE: Side-by-side ultralight/kitbuilt.

PROGRAMME: Developed as P 220 UL from Pottier P 220 S Koala; extensive redesign started in September 1996; prototype (OK-CUR 97), then known as Eurostar, made first flight May 1997; first customer delivery October 1997. Certified as ultralight in Belgium, Czech Republic, Finland, France, Germany, Italy, Slovak Republic, Spain, Switzerland and United Kingdom. First UK-built example (G-NIDG, by distributor Cosmik Aviation) flown in April 2000. Local assembly in China by Guizhou Evektor Aircraft Corporation (GEAC); first flight by Chinese-assembled EV-97, 24 October 2000; this agreement ended 2005 and aircraft now sold direct, although a Chinese UAV has been developed.

CURRENT VERSIONS: **Eurostar 2000:** Introduced late 1999, replacing Eurostar Model 99. Increased fuselage width (4 cm; 1 in); modified wingtips and increased span; larger ailerons; steerable nosewheel; flush, oval nose air intake. Available factory-built or as kit.

teamEurostar 2001: Further-improved version, introduced in early 2001; choice of Rotax 912 UL or more powerful 912 ULS engine. Name changed to avoid conflict with Eurostar France-UK rail link.

teamEurostar 2002: Further improved version meeting Sport Pilot NRPM in USA.

teamEurostar 2005: Further improvements incorporated, including optional electric flaps and new cockpit layout; *as described*.

CUSTOMERS: More than 500 (all versions) ordered, including 36 Model 2000, of which 470 were flying by August 2005. Customers in Belgium, Czech Republic, Estonia, Finland, France, Germany, Ireland, Italy, Netherlands, Poland, Portugal, Russia, Slovak Republic, Spain, Sweden, UK, Ukraine and USA.

COSTS: EUR52,000 excluding taxes (2006).

DESIGN FEATURES: Low-wing monoplane; modified NACA 4415 aerofoil section; dihedral 3°. Wing folding optional.

FLYING CONTROLS: Conventional and manual. Dual controls, rod-operated ailerons and elevator. Four-position (0/15/30/50°) mechanically operated split flaps; electrical operation optional. Elevators, starboard aileron and rudder have trim tabs.

STRUCTURE: Fuselage, wings and empennage of anodised, corrosion-proofed aluminium, riveted and bonded; wingtips, cowling and mainwheel legs in GFRP.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted cantilever mainwheel legs. Hydraulic mainwheel disc brakes and (in current version) steerable nosewheel. Wheel sizes 350x140 (main), 300x100 (nose). Optional wheel fairings or mudguards. Optional floats and skis.

POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL flat-four engine standard, with VZLU V230C two-blade, fixed-pitch wooden propeller; 73.5 kW (98.6 hp) Rotax 912 ULS and V534BD-UL three-blade, constant-speed (hydraulic), wooden propeller optional. Jabiru 2200 also optional. Fuel capacity 70 litres (18.5 US gallons; 15.4 Imp gallons) of which 65 litres (17.2 US gallons; 14.3 Imp gallons) are usable.

ACCOMMODATION: Front-hinged, upward-opening canopy, with additional transparency aft of rear frame. Space for 15 kg (33 lb) of baggage aft of seats. Early versions had canopy/rear transparency break line further forward. Optional replacement of rear transparency by metal fairing and bulged cabin sides.

SYSTEMS: 12 V (battery) electrical system.

AVIONICS: To customer's specification.

EQUIPMENT: Optional ballistic parachute, wing-folding mechanism and aero-tow hook.



Evektor EV-97 teamEurostar (Paul Jackson) 1159062

DIMENSIONS, EXTERNAL:	
Wing span	8.10 m (26 ft 7 in)
Length overall	5.98 m (19 ft 7½ in)
Fuselage max width	1.04 m (3 ft 5 in)
Height overall	2.34 m (7 ft 8¼ in)
Wheel track	1.60 m (5 ft 3 in)
Wheelbase	1.40 m (4 ft 7 in)
DIMENSIONS, INTERNAL:	
Cabin max width: standard	1.04 m (3 ft 5 in)
optional	1.18 m (3 ft 10½ in)
AREAS:	
Wings, gross	9.84 m ² (105.9 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	262 kg (578 lb)
Max T-O weight	450 kg (992 lb) ¹
¹ 480 kg (1,058 lb) permitted in Slovak Republic and United Kingdom	
PERFORMANCE (at 450 kg; 992 lb MTOW, A: Rotax 912 UL engine, B: Rotax 912 ULS):	
Never-exceed speed (VNE):	
A, B	145 kt (270 km/h; 167 mph) IAS
Max level speed: A	121 kt (225 km/h; 139 mph) IAS
B	132 kt (245 km/h; 152 mph) IAS
Max cruising speed: A	97 kt (180 km/h; 112 mph) IAS
B	108 kt (200 km/h; 124 mph) IAS
Stalling speed, flaps down:	
A, B	36 kt (65 km/h; 41 mph) CAS
Max rate of climb at S/L: A	330 m (1,083 ft)/min
B	480 m (1,574 ft)/min
Service ceiling: A, B	5,000 m (16,400 ft)
T-O run: A	145 m (475 ft)
B	100 m (330 ft)
Landing run: A, B	200 m (660 ft)
Max range, standard fuel:	
A, B	432 n miles (800 km; 497 miles)
g limits: A, B	+6/−3
OPERATIONAL NOISE LEVELS:	
To German LSL Chapter 6	60 dBA

EVEKTOR HARMONY

TYPE: Two-seat lightplane.

PROGRAMME: Revealed (then called EV-97 VLA) 1999; renamed Harmony and made first flight (OK-VLA) 6 April 2001; certification to JAR-VLA standard achieved 13 January 2003, but no known production up to mid-2006, despite continuing promotion.

COSTS: EUR79,900 to EUR95,490 (excluding VAT), depending upon avionics fit (2003).

DESIGN FEATURES: Heavier/more powerful version of teamEurostar, conforming to JAR-VLA and BCAR Section S. Reinforced fuselage aft of cockpit; slightly wider wheel track. Split flaps deflect 0/15/40° and extend over two-thirds of wing length.

Description as for teamEurostar 2002 except as follows:

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS flat-four engine; VZLU V230E two-blade, fixed-pitch, wooden propeller. Standard fuel capacity 67 litres (17.7 US gallons; 14.7 Imp gallons).

ACCOMMODATION: Two seats side by side; dual controls. Front-hinged canopy, with larger size of rear transparency (refer EV-97). Baggage space aft of seats.

AVIONICS: VFR instrumentation only in basic aircraft. 'Effect' version adds VSI, turn co-ordinator, VHF com antenna, PM 1000 intercom, Bendix/King KT 76A transponder, ACK encoder, KY 97A VHF and DME/transponder antenna. Top-of-range 'Harmony Excellent' suite omits KY 97A and ACK encoder, but adds KLN 35A GPS with KA 92 antenna, KX 125 nav/com, KT 76A transponder, DME/transponder and VHF antennae, VOR/glideslope antenna, artificial horizon and directional gyro. Further options available.

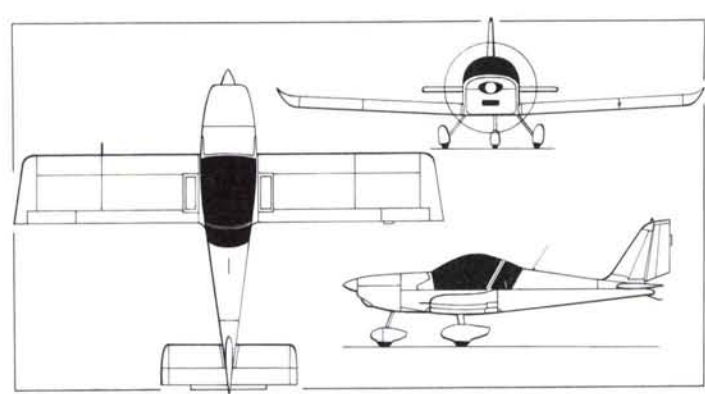
DIMENSIONS: As for teamEurostar

AREAS:

Wings, gross 10.13 m² (109.0 sq ft)



Evektor Harmony prototype/demonstrator 1128996



EV-AT EV-97 teamEurostar 2001 two-seat ultralight (James Goulding) (X)59970

WEIGHTS AND LOADINGS:	
Weight empty	330 kg (728 lb)
Max baggage weight	15 kg (33 lb)
Max T-O weight	575 kg (1,267 lb)
Max wing loading	56.8 kg/m ² (11.63 lb/sq ft)
Max power loading	7.82 kg/kW (12.85 lb/hp)
PERFORMANCE (preliminary):	
Never-exceed speed (VNE)	145 kt (270 km/h; 167 mph) IAS
Max level speed	129 kt (240 km/h; 149 mph) IAS
Max cruising speed	111 kt (205 km/h; 127 mph) IAS
Stalling speed, flaps down	44 kt (80 km/h; 50 mph) CAS
Max rate of climb at S/L	300 m (984 ft)/min
Service ceiling	5,000 m (16,400 ft)
T-O run	130 m (425 ft)
T-O to 15 m (50 ft)	260 m (855 ft)
Landing from 15 m (50 ft)	480 m (1,575 ft)
Landing run	240 m (790 ft)
Range	388 n miles (720 km; 447 miles)
g limits	+5.7/-2.25

EVEKTOR SPORTSTAR

TYPE: Side-by-side lightplane/kitbuilt.

PROGRAMME: Announced in 2004, developed for the Light Sport Aircraft (LSA) category as a derivative of the earlier teamEurostar and Harmony. First flight mid-2003; certification achieved December 2003. Became first type to receive FAA Special Airworthiness Certificate for LSA category.

CURRENT VERSIONS: **SportStar**: Initial version, available as kit or ready to fly.

SportStar II: Improved version for LSA category; has tail skid with integral tie-down point; increased fuel capacity; and canopy with steel frame. Launched at Sun 'n' Fun, April 2006 under name of **SportStar SE (Special Edition)**.

CUSTOMERS: By October 2004, sales to Argentina, Australia, Canada, the Czech Republic, Romania and the United States has been achieved.

COSTS: Kit USD67,000; ready-to-fly USD98,500 (2006).

DESIGN FEATURES: Airframe based on the Harmony, with higher maximum take-off weight, increased wing span, wider cabin and redesigned landing gear.

Quoted quick-build kit time 200 hours.

FLYING CONTROLS: As teamEurostar; electric flaps.

STRUCTURE: As teamEurostar.

LANDING GEAR: As teamEurostar. Optional skis and floats.

POWER PLANT: One 73.4 kW (98.4 hp) Rotax 912 ULS driving a VZLU V230C three-blade on-ground adjustable-pitch propeller; 59.6 kW (79.9 hp) Rotax 912 UL can also be fitted. Usable fuel capacity 118 litres (31.2 US gallons; 26.0 Imp gallons) are usable.

AVIONICS: As teamEurostar; optional autopilot.

ACCOMMODATION: As teamEurostar.



Evektor SportStar cockpit 1128995



Evektor SportStar (II) SE at its launch in April 2006 (Paul Jackson)

EQUIPMENT: Optional ballistic parachute and aerotow hook.	
DIMENSIONS, EXTERNAL:	
Wing span	8.65 m (28 ft 4½ in)
Length overall	5.98 m (19 ft 7½ in)
Height overall	2.33 m (7 ft 7¾ in)
DIMENSIONS, INTERNAL:	
Cabin max width	1.18 m (3 ft 10½ in)
Baggage hold volume	0.18 m ³ (6.2 cu ft)
WEIGHTS AND LOADINGS:	
Weight empty	303 kg (668 lb)
Max baggage weight	25 kg (55 lb)
Max T-O weight	550 kg (1,212 lb)
Max power loading	7.50 kg/kW (12.32 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	146 kt (270 km/h; 168 mph)
Max operating speed	115 kt (213 km/h; 132 mph)
Normal cruising speed at 75% power	110 kt (204 km/h; 127 mph)
Stalling speed, power off: flaps up	44 kt (81 km/h; 51 mph)
flaps down	39 kt (72 km/h; 45 mph)
Max rate of climb at S/L	258 m (846 ft)/min
Service ceiling	4,000 m (13,120 ft)
T-O run	170 m (558 ft)
Landing run	165 m (541 ft)
Range with max fuel	700 n miles (1,296 km; 805 miles)
Endurance	8 h 0 min
g limits	+6/-3

EVEKTOR VUT 100 COBRA

TYPE: Four-seat lightplane.

PROGRAMME: Project started in 2000 at Brno University; intended to be first of a family of four- to seven-seat aircraft. Development began in August 2001, with construction of first VUT 100-120i prototype (OK-EVE) beginning in February 2003; first flight 11 November 2004 (official first flight 16 November 2004) and by January 2005 had completed 14 flights. Exhibited at Aero '05, Friedrichshafen, April 2005 and AirVenture '05, August 2005. Certification intended by end 2006.

CURRENT VERSIONS: **VUT 100-120i Cobra**: Baseline version, as described.

VUT 100-120TDi: Powered by 169 kW (227 hp) SMA SR 305 diesel engine driving an MT Propeller MTV-9 three-blade, constant-speed propeller, diameter 1.96 m (6 ft 5 in). Not yet introduced.

VUT 100-131i Super Cobra: Second version introduced; will have 235 kW (315 hp) Textron Lycoming IO-580-B1A driving MT-Propeller MTV-9 three-blade, constant-speed propeller, diameter 1.98 m (6 ft 6 in). Fuel capacity as VUT 100-120i. Prototype (OK-RAF) made first flight on 24 October 2006.

DESIGN FEATURES: Multipurpose, all-metal aircraft designed to meet FAR/JAR 23 and a range of tasks including sport flying, basic and advanced training and aero-towing.

FLYING CONTROLS: Conventional and manual. Electrically operated flaps.

STRUCTURE: All-metal airframe with composites non-structural parts, such as cowlings.

LANDING GEAR: Tricycle type; retractable.

POWER PLANT: One 149 kW (200 hp) Textron Lycoming IO-360-A1B6 flat-four, driving an MT-Propeller MTV-12 three-blade, constant-speed propeller. Fuel capacity 340 litres (89.8 US gallons; 74.8 Imp gallons) in all versions.

ACCOMMODATION: Pilot and up to four passengers.

All data are provisional.

AVIONICS: Comms: Garmin GMA 430 nav/com/GPS, GNC 250XL com/GPS, GTX 327 transponder and GMA 340 audio panel.

Flight: S-TEC S55X autopilot.

Instrumentation: SAGEM ICDS 10 primary flight display and multifunction display. Optional avionics include Bendix/King KN 62A DME, KR 87 ADF, Ryan 9900BX TAS and L-3 WX-500 stormscope.

DIMENSIONS, EXTERNAL:

Wing span

Length overall

Propeller diameter

DIMENSIONS, INTERNAL:

Cabin: Length

Max width

Max height



Prototype VUT 100-131i version of Evektor Cobra during its maiden flight on 24 October 2006

1040481



Prototype VUT 100 Cobra, designed and built by Evektor (Jan Fridrich)

1128997

WEIGHTS AND LOADINGS (A: 100-120i; B: 100-131i):

Weight empty: A	830 kg (1,830 lb)
B	880 kg (1,940 lb)
Max T-O weight: A	1,330 kg (2,932 lb)
B	1,451 kg (3,200 lb)

PERFORMANCE (A, B as above, estimated):

Max level speed: A	155 kt (287 km/h; 178 mph)
B	180 kt (333 km/h; 207 mph)

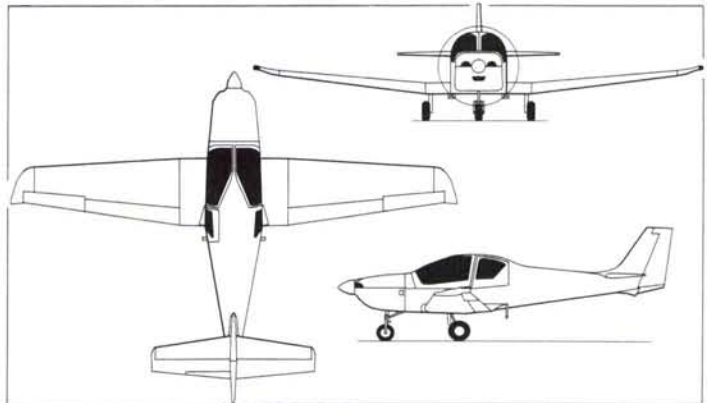
Stalling speed, flaps down:

A	50 kt (93 km/h; 58 mph)
B	55 kt (102 km/h; 64 mph)



Current Evektor VUT 100 Cobra instrument panel

1128998



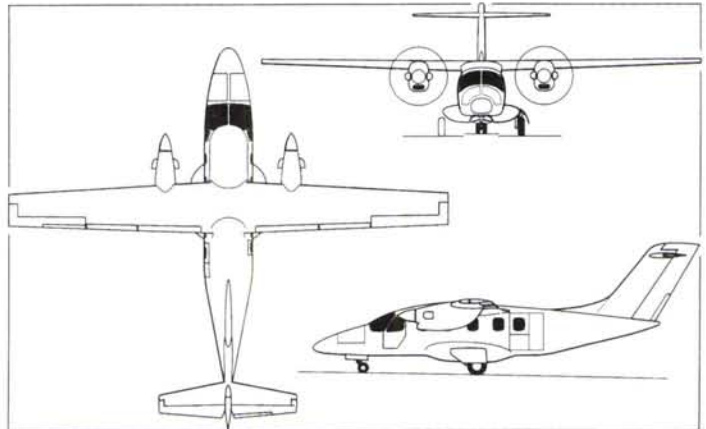
Evektor VUT 100 Cobra (Paul Jackson)

1128976

Max rate of climb at S/L: A, B	305 m (1,000 ft)/min
Range with max fuel:	
A	1,080 n miles (2,000 km; 1,242 miles)
B	1,000 n miles (1,852 km; 1,150 miles)
Endurance: A	8 h
B	6 h
g limits: Normal	+3.8/-1.52
Utility	+4.4/-1.76

EVEKTOR EV-55 OUTBACK

TYPE: Utility turboprop twin.
PROGRAMME: Announced in December 2003. Development being undertaken by Evektor as leader in a multi-company consortium; around 80 per cent of aircraft is sourced in the Czech Republic. Prototype expected to be flying by mid-2007, followed by EASA and FAA certification. First deliveries scheduled for 2009.
CUSTOMERS: Production expected to be 60 per year.
COSTS: Estimated USD1,700,000 (2006).
DESIGN FEATURES: High-wing utility aircraft with T-tail and modern aerodynamic design. Tapered, high-aspect ratio wing. Three models to be available: passenger, cargo and combi; medical evacuation model under consideration.
FLYING CONTROLS: Conventional and manual. Horn-balanced rudder and elevators. Trim tab in each aileron and elevator. Fowler flaps.
STRUCTURE: All-metal.
LANDING GEAR: Retractable tricycle type; mainwheels retract into nacelles on lower fuselage sides. Steerable nosewheel. Anti-skid system.
POWER PLANT: Two 400 kW (536 shp) Pratt and Whitney PT6A-21 turboprop engines, driving four-blade constant-speed, fully-feathering propellers.
ACCOMMODATION: Pilot and up to nine passengers standard; high-density option for 14 passengers; alternatively, cabin can be configured for cargo and combi use. Single pilot operation. Passenger door on port side of rear fuselage incorporates forward extension for cargo loading; cockpit door on each side forward of wing. Baggage compartments in nose (accessed by upward-hinged door) and in tailcone.
All data are provisional.
DIMENSIONS, EXTERNAL:
Wing span 16.10 m (52 ft 9 3/4 in)
Length overall 14.35 m (47 ft 1 in)
Height overall 4.66 m (15 ft 3 1/2 in)
Tailplane span 4.80 m (15 ft 9 in)
Wheel track 2.92 m (9 ft 7 in)
Wheelbase 4.17 m (13 ft 8 1/4 in)
Cargo door: Width 1.25 m (4 ft 1 1/4 in)
Height 1.13 m (3 ft 8 1/2 in)
DIMENSIONS, INTERNAL:
Cabin: Length 4.48 m (14 ft 8 1/4 in)
Max width 1.61 m (5 ft 3 1/4 in)
Min height 1.57 m (4 ft 6 in)
Volume 9.47 m³ (334.4 cu ft)
Baggage compartments volume (total) 3.20 m³ (113.0 cu ft)



Provisional general arrangement of Evektor EV-55 Outback (Paul Jackson)

1128977



Artist's impression of Evektor EV-55 Outback

1042817

WEIGHTS AND LOADINGS:

Weight empty	2,549 kg (5,620 lb)
Max payload	1,824 kg (4,021 lb)
Max T-O and landing weight	4,600 kg (10,141 lb)
Max power loading	5.76 kg/kW (9.46 lb/shp)

PERFORMANCE:

Max level speed at FL100	220 kt (408 km/h; 254 mph)
T-O to 15 m (50 ft)	420 m (1,378 ft)
Range: with 30 min reserves	1,240 n miles (2,298 km; 1,427 miles)

FANTASY AIR

FANTASY AIR GROUP

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Web: www.fantasyair.com
MANAGING DIRECTOR: Josef Jestřáb

Fantasy Air established at Písek 1995; initial product launched as Cora, in Legato and Allegro versions. By mid-2000 was standardising on variants of Allegro. Fantasy Air employs 23 workers at its 750 m² (8,073 sq ft) factory.

FANTASY AIR ALLEGRO

TYPE: Side-by-side ultralight/kitbuilt.
PROGRAMME: Certified in Australia, Belgium, Czech Republic, Finland, France and Germany; public debut at Friedrichshafen Air Show, May 1997. All are subvariants of Fantasy Cora. Legato subvariant no longer marketed; Arrius renamed as Allegro. Production rate three per month from 2001 onwards.
A new wing profile was first tested in May 2002. Revealed in the same month were plans to fit a Diesel Air D280 twin-piston engine, derated to 60.0 kW (80 hp); these were in abeyance by October 2002.
CURRENT VERSIONS: **Allegro ST**: Baseline version; 47.8 kW (64.1 hp) Rotax 582 UL. Remains available.
Allegro 200: As ST, but with 55.0 kW (73.8 hp) Rotax 618 UL. Remains available.
Allegro 2000: Introduced from 1 March 2000 (kit version introduced September 2000); United States S-LSA approval gained 19 May 2005; 59.6 kW (79.9 hp) Rotax 912 UL or (Allegro S) 73.5 kW (98.6 hp) 912 ULS. SportProp glass fibre or VZLU V331-3NC wooden three-blade propeller. Quoted build time 510 hours for standard kit and 190 hours for quick-build kit. Certified in Belgium, Czech Republic, Denmark, Finland, Germany and Spain.
Allegro SW: Short-span (Speed Wing) version, without taper on outer panels. New SM 701 aerofoil section wing and 47.8 kW (64.1 hp) Rotax 582 UL or 59.6 kW (79.9 hp) Rotax 912 UL. German marketing only with Rotax 912 UL and propeller options as for Allegro 2000. Four to France in September 1999, where certification subsequently awarded; also certified in Czech Republic and Spain. Kit version available from 1 March 2000.



Fantasy Air Allegro 2000 'Light Sport' being promoted for US LSA market (Paul Jackson) 1159064



Aspects of Fantasy Air Allegro 2007 prototype

1040477

Allegro 2000 F: (formerly Arrius F) Float-equipped, standard-span wing (SM 701 section) and Rotax 912 UL or 912 ULS. Two to Finland in August 1999. First flight (converted Allegro, OK-DUU 03) 5 November 1999.
Allegro 2007: Improved version introduced October 2006, incorporating feedback from existing customers. Fuselage width increased by 10 cm (4 in); wing position raised 9 cm (3½ in) to give improved cabin height, and rear fuselage and tail redesigned and raised (vertical surfaces shortened in height and increased in chord) for improved ground clearance. Prototype OK-LUU 19.
CUSTOMERS: Total 70 (51 kits and 19 factory-built, including a few Cora Legatos) registered in Czech Republic by November 2000. Exports to Finland and Hungary began in 2000; followed by Luxembourg, Italy and Netherlands in 2001; Portugal and Belgium in 2002; USA in 2003; and Canada in 2004. Total sales by October 2002 exceeded 140, including 75 in Czech Republic, 27 in France and 17 in Germany; 32 built in 2000, 35 in 2001 and 34 in 2002. At least 40 in US by mid-2006, at which time company estimated over 450 flying worldwide.
COSTS: Allegro 2000 USD57,225; Allegro 2000 quick-build kit USD23,625 (both 2006).
DESIGN FEATURES: Braced high-wing monoplane; T tail; tapered outer panels on 2000, constant chord throughout on SW. UA-2 aerofoil section on ST and 200, improved SM 701 on 2000 and SW; dihedral 1° 10' on Allegro 2000; 1° 30' on Allegro SW. Quoted build time for kit version 190 hours.
FLYING CONTROLS: Conventional and manual. Electrically actuated flaperons (settings 0/15/48°). In-flight-adjustable tab in port half of elevator; ground-adjustable rudder tab.
STRUCTURE: Fabric- and metal-covered metal wings with welded steel tube centre-section and full-span metal flaperons; laminated glass fibre fuselage and integral fin; all-metal rudder, tailplane and one-piece elevator.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring Kevlar cantilever mainwheel legs and 350 mm wheels, rubber-block shock-absorbers, hydraulic mainwheel brakes and steerable nosewheel; wheel spats. Full Lotus twin-float gear to be certified for Allegro 2000 F; testing undertaken (with OK-DUU 03) in August 2001.

POWER PLANT: One Rotax engine (details under Current Versions); SportProp three-blade, glass fibre or Junkers Profly two-blade, ground-adjustable pitch, carbon fibre propeller. Fuel capacity in Allegro 2000 55 litres (14.5 US gallons; 12.1 Imp gallons); increased in Allegro 2007 to 63 litres (16.6 US gallons; 13.9 Imp gallons); optional 23 litre (6.0 US gallon; 5.0 Imp gallon) tanks (in either version) can be fitted in each wing.

EQUIPMENT: Junkers recovery parachute optional.

DIMENSIONS, EXTERNAL (A: 2000, B: 2000 F, C: SW):

Wing span: A, B 10.81 m (35 ft 5½ in)
C 9.63 m (31 ft 7 in)

Length overall: A 6.36 m (20 ft 10½ in)
B, C 6.10 m (20 ft 0¼ in)

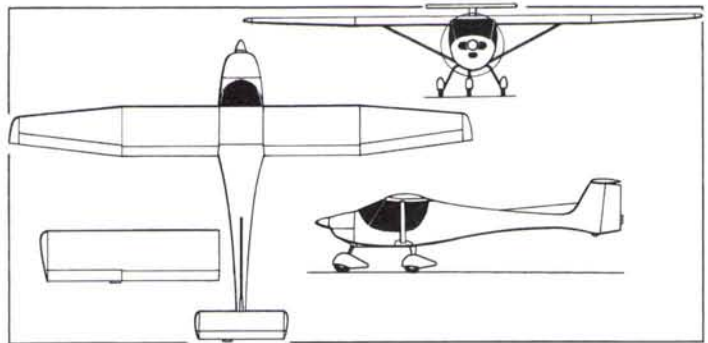
Height overall: all 2.05 m (6 ft 8¾ in)

DIMENSIONS, INTERNAL:

Cabin max width: A, B, C 1.08 m (3 ft 6½ in)

AREAS:

Wings, gross: A, B 11.37 m² (122.4 sq ft)
C 11.55 m² (124.3 sq ft)



Fantasy Air Cora Allegro 2000, with scrap view of short-span SW wing (James Goulding) 1128978



Comparison of Fantasy Air Allegro 2007 (right) with 2000 version 1040476

WEIGHTS AND LOADINGS:

Weight empty: A, B, C 285–295 kg (628–650 lb)
Max T-O weight: A, C¹ 450 kg (992 lb)
B 520 kg (1,146 lb)

¹ 559 kg (1,232 lb) where regulations permit.

PERFORMANCE, POWERED (Rotax 912 UL):

Never-exceed speed (VNE):

A 118 kt (220 km/h; 136 mph)
B, C 108 kt (200 km/h; 124 mph)

Max cruising speed at 75% power:

A 89 kt (165 km/h; 103 mph)
B 97 kt (180 km/h; 112 mph)

Stalling speed: A, B, C 36 kt (65 km/h; 41 mph)

Max rate of climb at S/L: A 360 m (1,181 ft)/min
B 240 m (787 ft)/min
C 300 m (984 ft)/min

T-O run: A, C 150 m (495 ft)
B 220 m (722 ft)

Landing run: A, C 100 m (330 ft)
B 120 m (395 ft)

Max range: A, C 270 n miles (500 km; 310 miles)
B 297 n miles (550 km; 341 miles)

PERFORMANCE, UNPOWERED:

Best glide ratio: A, B 12
C 10

FLYING MACHINES

FLYING MACHINES
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Web: www.flyingmachines.cz

Company has expanded its aviation interests from flex-wings to three-axis ultralights.

FLYING MACHINES B612

TYPE: Single-seat ultralight/kitbuilt.

PROGRAMME: Prototype B-612 (OK-GUZ 02), designed and built by Ing Marek Ivanov; first flight in or by October 2001. Established FAI subclass RAL1 speed record of 104.9 kt (194.2 km/h; 120.7 mph) on 11 October 2003, then powered by a 29.5 kW (39.6 hp) Rotax 447 two-cylinder, in-line piston engine. Production version has wider (0.70 m; 2 ft 3½ in) cockpit.

COSTS: EUR25,845 with HKS engine, EUR22,100 with Rotax engine; kit, less engine and instruments EUR16,300; all plus tax (2006).

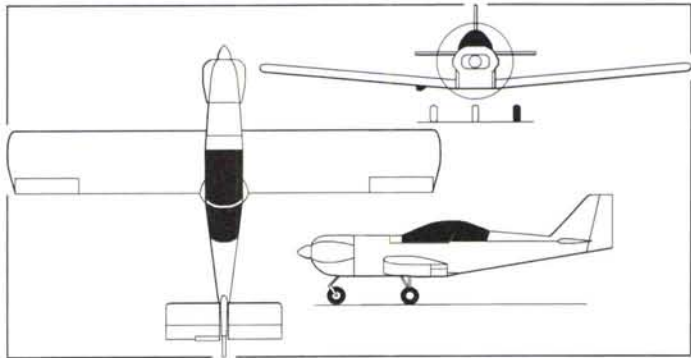
DESIGN FEATURES: Low-mounted, constant-chord wing; low-mounted, cantilever tailplane; sweptback fin. Wings removable for storage.

FLYING CONTROLS: Conventional and manual. No aerodynamic balances. Split flaps.

STRUCTURE: Welded 4130 chromoly steel fuselage with Ceconite fabric covering; composites empennage in current versions. Epoxy composites wing with carbon fibre main spar.

LANDING GEAR: Tricycle type; retractable. Mainwheels on welded steel legs, with hydraulic shock absorbers, retract outwards by manual hydraulic pump; wheel extremities protrude below wing lower surface when retracted. Steerable nosewheel. Mainwheel brakes.

POWER PLANT: One piston engine: 44.7 kW (60 hp) HKS 700E or 36.8 kW (49.3 hp) Rotax 503 driving a two-blade Sportprop propeller. Fuel capacity 30 litres (7.9 US gallons; 6.6 Imp gallons) in composites tank at rear of engine firewall or, optionally, in two wing tanks with combined capacity of 50 litres (13.2 US gallons; 11.0 Imp gallons).



Flying Machines B612 ultralight (Paul Jackson) 1159581

EQUIPMENT: Optional ballistic recovery parachute.

DIMENSIONS, EXTERNAL:

Wing span 6.85 m (22 ft 5¾ in)
Length overall 4.80 m (15 ft 9 in)
Height overall 1.76 m (5 ft 9¼ in)

DIMENSIONS, INTERNAL:

Cockpit max width 0.60 m (1 ft 11¾ in)

AREAS:

Wings, gross 6.85 m² (73.7 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 175 kg (386 lb)
Max T-O weight 300 kg (661 lb)



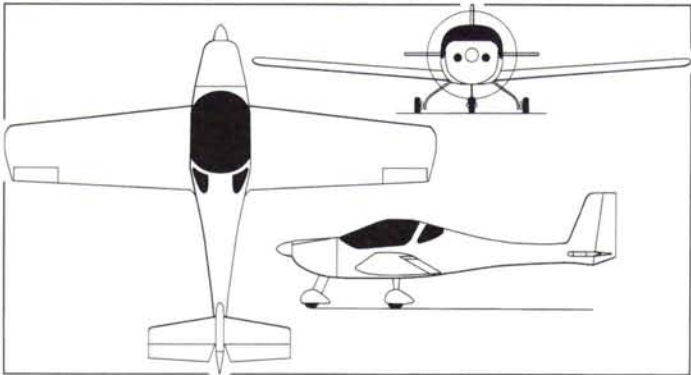
Flying Machines B612 single-seat ultralight 1158656

PERFORMANCE (HKS engine and wing tanks):

Never-exceed speed (VNE)	145 kt (270 km/h; 167 mph)
Normal cruising speed	108 kt (200 km/h; 124 mph)
Stalling speed	36 kt (65 km/h; 41 mph)
T-O run	50 m (165 ft)
T-O to 15 m (50 ft)	130 m (430 ft)
Landing from 15 m (50 ft)	120 m (395 ft)
Max rate of climb at S/L	360 m (1,181 ft)/min
Max range	486 n miles (900 km; 559 miles)
g limits	+4/-2

FLYING MACHINES FM 250 VAMPIRE

TYPE: Side-by-side ultralight.
DESIGN FEATURES: Low-mounted wing and tailplane; sweptback fin. Fuselage waisted aft of cockpit for weight saving.
FLYING CONTROLS: Conventional and manual. No aerodynamic balances. Trim tab in starboard elevator. Flaps.
STRUCTURE: Composites, except aluminium alloy control surfaces. Sandwich fuselage construction.
LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, spring composites cantilever mainwheel legs; steerable nosewheel on welded steel leg. Mainwheel hydraulic brakes. Optional wheel fairings.
POWER PLANT: One Rotax flat-four; option of 58.8 kW (78.9 hp) 912 UL, 73.5 kW (98.6 hp) 912 ULS or 76.9 kW (103.1 hp) 914. Integral, composites tank in starboard wing; capacity 68 litres (17.9 US gallons; 15.0 Imp gallons); mechanical pump for Rotax 912/912ULS; electric pump for 914. Fixed-, ground adjustable-, flight adjustable-pitch and constant-speed propeller options.
DIMENSIONS, EXTERNAL:
Wing span 7.66 m (25 ft 1½ in)
Length overall 6.065 m (19 ft 10¾ in)
Height overall 2.16 m (7 ft 1 in)



Flying Machines FM 250 two-seat ultralight (Paul Jackson)

1159583

AREAS:

Wings, gross	10.05 m ² (108.2 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	255 kg (562 lb)
Max T-O weight	472.5 kg (1,041 lb)

PERFORMANCE:

Never-exceed speed (VNE)	145 kt (270 km/h; 167 mph)
Manoeuvring speed	84 kt (156 km/h; 97 mph)
Stalling speed, flaps and gear down	36 kt (65 km/h; 41 mph)
Max rate of climb at S/L	420 m (1,378 ft)/min
g limits	+4.43/-2.43



Flying Machines FM 250 two-seat ultralight

1158667

FMP

FMP S.R.O.

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e-mail: aero.fpm@quick.cz
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PRESIDENT: Vladimír Bláha
HEAD OF ENGINEERING: Ing Tomáš Bartoň

WORKS:
5.kvitna 813, CZ-51251 Lomnice nad Popelkou

Formed in 1991, FMP produces a range of light engineering items including valves and connectors and has a workforce of 200. In 2004, it took over production of the Qualt 200 ultralight from Interplane.

FMP QUALT

TYPE: Side-by-side ultralight kitbuilt.
PROGRAMME: Original design by Aerosport. Certified in ULA category. Improved Qualt 201 series introduced in 2005, with enlarged cabin, reprofiled aerofoil, epoxy resin fuselage, tail and undercarriage, and composites wing.
CURRENT VERSIONS: **Qualt 200J**: Baseline model, powered by Jabiru 2200; replaced by Qualt 201J in 2005.
Qualt 200R: As 200J but with Rotax 912 engine; replaced by Qualt 201R in 2005.
Qualt 200RS: As 200J, but with Rotax 912S engine; replaced by Qualt 201RS in 2005.
Qualt 201J: Baseline version, powered by Jabiru 2200.
Qualt 201R582: As 201J, but with Rotax 582 engine.
Qualt 201R: As 201J, but with Rotax 912 engine.
Qualt 201RS: As 201J, but with Rotax 912S engine.

Qualt 201RS Super: As 201J, but with choice of 73.5 kW (98.6 hp) Rotax 912S3 or 89.5 kW (120 hp) Jabiru 3300 engine; max T-O weight of 558 kg (1,230 lb) where regulations permit, including US LSA category.

Interplane Skyboy 2000L and Interplane Falcon 2000L: Aircraft marketed by Interplane.

COSTS: Kit, firewall back EUR25,752 (2006).
DESIGN FEATURES: Typical low-wing, T-tail ultralight with large bubble canopy for good outward view. Tapered wing with upturned tips; large trailing-edge root glove.
FLYING CONTROLS: Conventional and manual. Horn-balanced elevators. Split flaps.
STRUCTURE: Fuselage and empennage of epoxy resin; wing of composites.
LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted spring epoxy resin cantilever mainwheel legs. Steerable tailwheel.
POWER PLANT: **Qualt 201J**: One 59.7 kW (80 hp) Jabiru 2200 driving a VZLU V237 DF propeller.
Qualt 201R582: One 47.8 kW (64.1 hp) Rotax 582 driving a VZLU V230C propeller.
Qualt 201R: One 59.6 kW (79.9 hp) Rotax 912 driving a VZLU V230D propeller; other propellers from VZLU and KA can be fitted optionally.
Qualt 201RS: One 73.5 kW (98.6 hp) Rotax 912S driving a VZLU V230E propeller; other propellers from VZLU and KA optional.
Fuel capacity for all versions 47 litres (12.4 US gallons; 10.3 Imp gallons).

DIMENSIONS, EXTERNAL:

Wing span	9.20 m (30 ft 2¼ in)
Length overall: Q201J	6.10 m (20 ft 0¼ in)
Q201582	6.05 m (19 ft 10¼ in)
Q201R, Q201RS	6.00 m (19 ft 8¼ in)
Height overall	1.72 m (5 ft 7¾ in)

AREAS:

Wings, gross	10.50 m ² (113.0 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty: Q201J, Q201R582	265 kg (584 lb)
Q201R	282 kg (622 lb)
Q201RS	286 kg (631 lb)
Max T-O weight	450 kg (992 lb)



FMP Qualt 201J, launched in 2005 (Paul Jackson)

1159065

PERFORMANCE:

Never-exceed speed (VNE)	137 kt (254 km/h; 157 mph)	Q201R582	65-81 kt (120-150 km/h; 75-93 mph)
Max operating speed: 200J	124 kt (230 km/h; 142 mph)	Stalling speed, flaps down: all	33 kt (60 km/h; 38 mph)
Q201R582	97 kt (180 km/h; 111 mph)	Max rate of climb at S/L: 201R582	192 m (630 ft)/min
Q201R	118 kt (220 km/h; 136 mph)	201J, 201R	300 m (984 ft)/min
Q201RS	128 kt (237 km/h; 147 mph)	201RS	396 m (1,299 ft)/min
Normal cruising speed range: all except Q201R582	76-103 kt (140-190 km/h; 87-118 mph)	T-O and landing run	200 m (656 ft)
		Range with max fuel	405 n miles (750 km; 466 miles)

INTERPLANE

INTERPLANE SPOL S.R.O.

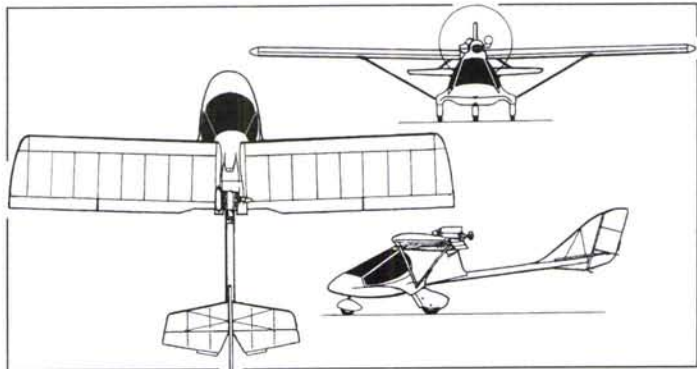
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e-mail: interplane@hotmail.com
PRESIDENT: Ben Dawson

Interplane was created as an ultralight manufacturer in 1992; design and product development is by Gryf Development company at Hodonin. Its first product, the Griffon, is no longer being promoted.

Interplane also markets the Dewald **Sunny** and the FMP Qualt 200L low-wing two-seater as the **Skyboy 2000L** (or **Falcon 2000L**), price USD39,900. Latter due to be relaunched as Interplane **S2 Falcon**. New FM 250 Vampir launched in 2006.



Interplane Skyboy, showing optional flaps (Paul Jackson)

1128979

INTERPLANE SKYBOY

TYPE: Side-by-side ultralight/kitbuilt.
PROGRAMME: Prototype designed by team led by Jaroslav Dostal; first flown 1993; entered production 1994; conforms to Czech UL-2 and German BFU-DULV standards. Certified in Czech Republic (1994), France (1996), Slovak Republic and Germany (excluding noise tests, 1999). Current EX and UL versions introduced in 1999. New canopy design permits operation without doors for hot-weather flying.

CURRENT VERSIONS: **Skyboy**: Initial version, with Rotax 503 or 582 engine as standard and cockpit width of 1.20 m (3 ft 11¼ in); no longer produced.

Skyboy S: Reinforced version for higher MTOW and speeds; Rotax 582 engine and choice of wing spans; no longer produced.

Skyboy EX: Standard version from 1999; for European customers; also for customers in Australia and US, where it is classified in the FAA Experimental category.

Skyboy UL: Specially lightened (empty weight 225 kg; 496 lb) to meet US FAR Pt 103 ultralight trainer regulations.

Skyboy ZK-F: Version with wing flaps; MTOW 475 kg (1,047 lb), where local regulations allow.

Skyboy LSA-F: MTOW 560 kg (1,234 lb) to meet Sport Pilot regulations. Was to be marketed as **S1 Cobra**, but discontinued.

S1A Cobra: Amphibian version offered in US with choice of aluminium or composites floats; no longer offered.

Skyboy XJ: Tractor propeller version with WarpDrive three-blade, ground-adjustable pitch propeller. Composites Fuselage with fabric-covered wings and ailerons. Fuel capacity 56 litres (14.8 US gallons; 12.3 Imp gallons); prototype OK-IUR 21. By early 2005, this was reported to have been abandoned, despite display of the prototype at Sun 'n' Fun in April 2004 and simultaneous US registry as N69877. Also reported are plans for relaunch as Interplane **S3 Eagle**. Other features include fuselage-mounted spring cantilever



Interplane Skyboy two-seat ultralight (Paul Jackson)

1159066

composites mainwheel legs; built-up rear decking to pod; BRS parachute; hydraulic brakes and V-strut ZK-F wings. External mass balance on elevators; Flight-adjustable trim tabs attached to each elevator; ground-adjustable rudder tab. Length 6.86 m (22 ft 6 in); height 2.34 m (7 ft 8 in).

CUSTOMERS: Total of 115 registered by August 2005, including 34 on the FAA register. Sales to Australia, Austria, Belgium, Bulgaria, Canada, Czech Republic, Denmark, France, Germany, Luxembourg, Mexico, Netherlands, Poland, Portugal, Slovak Republic, South Korea, Thailand and US.

COSTS: UL: Flyaway USD33,025 (2006).

Description applies to Skybay UL.

DESIGN FEATURES: High, constant-chord wing, boom-mounted empennage and pusher propeller. Available factory-built or (with or without power plant and instruments) as kit. Wing struts and tail surfaces can be folded for transportation and storage.

Wing aerofoil section NACA 4412; dihedral 1° 30'; incidence 4° 30'. Leading-edges swept forward 2°.

FLYING CONTROLS: Conventional and manual. Tabs on rudder and each elevator; flaps optional. **STRUCTURE:** Aluminium tube primary structure with glass fibre and fabric covering.

LANDING GEAR: Tricycle type; fixed. Coil spring/hydraulic (motorcar-type) shock-absorbers on trailing-link mainwheels and castoring nosewheel; tyre sizes 14.4 (mainwheels) and 12.4 (nosewheel); mechanical or hydraulic brakes on nosewheel only. Ski and float gear optional.

POWER PLANT: One 47.8 kW (64.1 hp) Rotax 582 UL two-cylinder in-line two-stroke engine standard; 59.6 kW (79.9 hp) Rotax 912 UL or 73.5 kW (98.6 hp) Rotax 912 ULS flat four; Rotax 462, 503 or 618; Hirth 2706; or Verner SVS 1400 optional. Wide choice of two- to six-blade wooden or laminate pusher propellers (three-blade, carbon fibre Junkers Profly

standard). Standard fuel capacity 38 litres (10.0 US gallons; 8.4 Imp gallons); optional fuel capacity 57 litres (15.0 US gallons; 12.5 Imp gallons).

ACCOMMODATION: Optional cabin doors.

EQUIPMENT: Optional Magnum 450 or 560 ballistic recovery parachute.

DIMENSIONS, EXTERNAL:

Wing span 9.12 m (29 ft 11 in)

Length overall 6.37 m (20 ft 10 1/4 in)

Height overall 2.13 m (6 ft 11 3/4 in)

DIMENSIONS, INTERNAL:

Cockpit max width 1.24 m (4 ft 1 in)

AREAS:

Wings, gross: without flaps 12.87 m² (138.5 sq ft)

with flaps 13.38 m² (144.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped 225 kg (496 lb)

Max T-O weight 450 kg (992 lb) or 558 kg (1,232 lb)

PERFORMANCE (Rotax 912, 558 kg; 1,232 lb MTOW):

Max level speed 75 kt (138 km/h; 86 mph)

Econ cruising speed 56 kt (105 km/h; 65 mph)

Stalling speed 34 kt (63 km/h; 40 mph)

Max rate of climb at S/L 306 m (1,004 ft)/min

T-O run 122 m (400 ft)

Landing run 152 m (500 ft)

Range with standard fuel 160 n miles (296 km; 184 miles)

JIHLAVAN

JIHLAVAB AIRPLANES S.R.O.

Znojemska 64, CZ-586 52 Jihlava

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Web: www.ultralight.cz

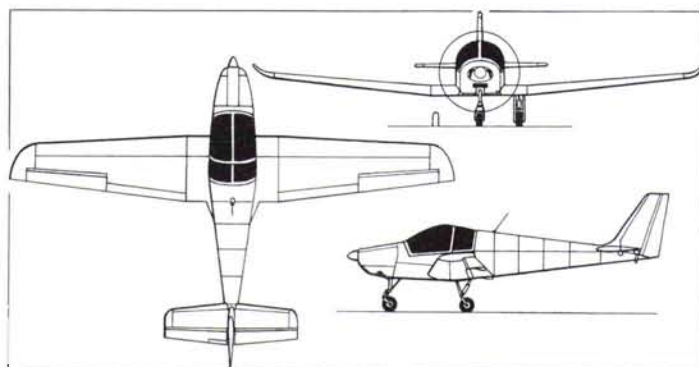
CHIEF DESIGNER: Antonin Přístěk

EXPORT SALES MANAGER: Miroslav Boubela

Founded in 1952, Jihlavan a.s. has produced components for most of the major aircraft manufacturing programmes undertaken since then in the former Czechoslovakia. Other branches of the company produce agricultural vehicles and fork lift trucks.

Between 1998 and 2000, Jihlavan built the Sova lightplane for Kappa 77, manufacturing responsibility then passing to the designer. However, Jihlavan obtained manufacturing rights to the Sova in 2003, shortly before Kappa entered bankruptcy. The aircraft was re-launched as the Jihlavan Rapid following establishment of Jihlavan Airplanes s.r.o. on 2 March 2005.

In late 2005, the aviation workforce numbered 90.



Jihlavan KP 2U Rapid 200 (James Goulding)

1128980

CUSTOMERS: Over 140 sold by end 2005; customers in Belgium, Brazil, Czech Republic, Ecuador, Finland, France, Germany (known as KPD-2U), Italy, Netherlands, Poland, Portugal, Spain, South Africa and USA.

COSTS: Master EUR59,800; Major EUR65,000; both excluding tax, flyaway (2006).

DESIGN FEATURES: Low-wing monoplane conforming to BfU 95 regulations. Tapered wing with swept tips; sweptback fin with low tailplane.

Wing sections NACA GA(W)-1 at root and GA(W)-2 at tip; dihedral 6°. Fin and tailplane sections NACA 0012.

FLYING CONTROLS: Conventional and manual. Aileron actuation by pushrods. Electrically operated trim tab in port elevator; manually or electrically operated Fowler flaps (deflection 10 and 35°).

STRUCTURE: All-metal, except for CFRP cockpit frame. Two-spar wings detachable for storage. Fuselage constructed from Dural L-shape stringers, riveted bulkheads and Dural skin.

LANDING GEAR: Electrically retractable tricycle type (all units rearward) with manual override; rubber shock-absorption; mainwheels semi-exposed when retracted. Steerable nosewheel; hydraulic brakes. Fixed gear optional.

POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL engine, with 4:1 reduction drive to a three-blade ground-adjustable pitch propeller; can alternatively accommodate 73.5 kW (98.6 hp) Rotax 912 ULS or 84.5 kW (113.3 hp) Rotax 914 and be fitted with Kaspar or Wecomp Vária two-blade flight adjustable propellers; from 2006, 59.7 kW (80 hp) Jabiru

JIHLAVAN KP 2U RAPID

TYPE: Side by side ultralight.

PROGRAMME: Designed by Kappa 77 company and Institute of Aerospace Engineering at Brno Technical University and developed over a 22 month period. Initially named Kappa Sova (Owl). First of two flying prototypes (OK-BUJ 23) first flown 26 May 1996; first public demonstration the following month at Jihlava Aero '96. Czech certification 23 September 1997; German certification, and of kit by FAA, in June 1999, followed by Polish certification in April 2001, Portuguese in June 2002, Australian at end 2003, Spanish certification planned for 2006. Approved for use in Brazil, Canada, Ecuador, Finland, France, Italy, Netherlands, South Africa and Spain.

Following Kappa's bankruptcy in 2004, production continued by Jihlavan Airplanes under new name of Rapid and with modifications including new shape of engine cowling; revised canopy locking and cockpit seating arrangements, and electrically operated Fowler flaps.

CURRENT VERSIONS: KP-2U Rapid 200: As described. Available as Master baseline version, or as Major, with additional avionics and features.

KP-5 ASA Rapid 500: See separate entry.



Jihlavan KP 2U Rapid 200 making the type's relaunch at Aero '05, Friedrichshafen, one month after formation of Jihlavan Airplanes (Paul Jackson)

1121619

2200 added to options. Fuel capacity (two wing centre-section tanks) 64 litres (16.9 US gallons; 14.1 Imp gallons). Optional two additional tanks each 15 litres (4.0 US gallons; 3.3 Imp gallons). Max fuel capacity 94 litres (24.8 US gallons; 20.7 Imp gallons). ACCOMMODATION: Forward-hinged canopy. Dual controls. Starboard seat staggered rearwards 20 cm (8 in). Space behind seats for 30 kg (66 lb) of baggage. EQUIPMENT: Optional emergency system under consideration.

DIMENSIONS, EXTERNAL:

Wing span	9.90 m (32 ft 5¾ in)
Length overall	7.165 m (23 ft 6 in)
Height overall	2.60 m (8 ft 6¼ in)
Propeller diameter	1.73 m (5 ft 8 in)

AREAS:

Wings, gross	11.85 m ² (127.6 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	282 kg (622 lb)
Max T-O weight	472.5 kg (1,041 lb)

PERFORMANCE (Rotax 912 UL engine):

Max level speed	129 kt (240 km/h; 149 mph)
Max cruising speed at 75% power	108 kt (200 km/h; 124 mph)
Stalling speed: flaps up	39 kt (71 km/h; 45 mph)
flaps down	26 kt (48 km/h; 30 mph)
Max rate of climb at S/L	390 m (1,279 ft)/min
T-O run	100 m (330 ft)
Landing run	140 m (460 ft)
Range with max fuel	518 n miles (960 km; 596 miles)
g limits	+4/-2

JIHLAVAN KP 5 ASA RAPID 500

US marketing name: KP-5 Kappa

TYPE: Side-by-side ultralight/kitbuilt; two-seat lightplane.

PROGRAMME: Developed from Kappa's earlier KP 2U Sová, with financial backing from Czech Ministry of Industry and Trade. Prototype first flew December 2003; first public display at Narrownmine, Australia, in 2004. Czech certification received 29 March 2004. Australian certification during early 2004. FAA LSA approval gained 19 July 2005.

CURRENT VERSIONS: **KP 5 ASA Rapid 500:** Available as **Master** baseline version and **Major**, with additional avionics and features; *as described*.



Jihlavan KP 5 ASA Rapid 500 (Paul Jackson)

1159067

KLN

KLN
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Web: www.kln.cz
DESIGNER AND MANUFACTURER: Karel Klenor

KLN's VL-3 originated in design offices of Vanessa Air sro at Litomysl, a company managed by Ing Miroslav Kábrt and Petr Kábrt which has produced some 12 previous light aircraft concepts. KLN was established in 1990 by Karel and Nadia Klenor as a manufacturer of composites aerostructures and components for motor vehicles, sanitary ware and other applications. Occupied current premises in 1997. Workforce in 2005 was 200.

KLN VL-3

TYPE: Two-seat lightplane; side-by-side ultralight.

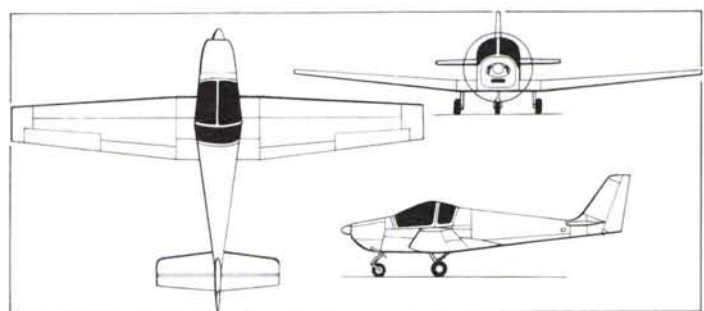
PROGRAMME: Prototype (OK-JUÚ 21) flew 6 June 2004 and made debut at CIAF air show, Brno, 4 September 2004; also exhibited at Aero '05, Friedrichshafen, in April 2005. Tests on a static airframe were undertaken in February and March 2005, prior to launch of series manufacture. On 19 October 2005 the prototype set a new FAI world speed record in class RAL2 (three-axis control microlights) of 143.0 kt (265 km/h; 164.7 mph). First fused landing gear example (OK-LUU 05) first flown April 2006.

DESIGN FEATURES: Aerodynamically efficient configuration in composites, with low, tapered wing and sweptback fin. Conforms to Czech UL-2 regulations for ultralights, or as lightplane to JAR-VLA, LSA, or equivalent.



Prototype (retractable landing gear) KLN VL-3

1159002



Jihlavan KP 5 Rapid 500 general arrangement (James Goulding)

1121597

KP-5 Kappa: Marketed in US by Kappa Aircraft of Pocono Pines, Pennsylvania (www.kappaaircraft.com) as factory-built LSA with 59.6 kW (79.9 hp) Rotax 912 or 73.5 kW (98.6 hp) Rotax 912S or 59.7 kW (80 hp) Jabiru 2200 or 89 kW (120 hp) Jabiru 3300 flat-four and 64 litre (17.0 US gallon; 14.2 Imp gallon) fuel capacity.

CUSTOMERS: Total of 16 aircraft sold to customers in Australia, South Africa and USA by end-2005.

COSTS: Master EUR62,800; Major EUR68,000; both flyaway, excluding taxes (2006).

DESIGN FEATURES: As KP 2U Rapid; conforms to Czech UL2 ultralight and most European equivalents at reduced MTOW, but optimised for Australian and US (LSA) markets.

FLYING CONTROLS: As KP 2U Rapid.

STRUCTURE: All-metal, two-spar wing and fuselage with CFRP cockpit frame.

LANDING GEAR: Tricycle-type; fixed. Optional spats. Rubber shock-absorption; steerable nosewheel; hydraulic brakes.

POWER PLANT: As KP 2U Rapid, but options cover 912 ULS and 914 only, plus Jabiru 2200. Fuel capacity as KP 2U Rapid, with option to increase to 94 litres (24.8 US gallons; 20.7 Imp gallons).

ACCOMMODATION: As KP 2U Rapid.

DIMENSIONS, EXTERNAL (As KP 2U Rapid, except):

Height overall: fixed gear	2.46 m (8 ft 0¾ in)
retractable gear	2.60 m (8 ft 6¼ in)
Propeller diameter	1.73 m (5 ft 8 in)

WEIGHTS AND LOADINGS:

Weight empty	320 kg (705 lb)
Baggage capacity	30 kg (66 lb)
Max T-O weight: Czech Republic	472.5 kg (1,041 lb)
Australia, USA	544 kg (1,199 lb)

PERFORMANCE (Rotax 912S engine):

Never-exceed speed (VNE)	141 kt (260 km/h; 162 mph)
Max level speed	120 kt (222 km/h; 138 mph)
Cruising speed	99 kt (183 km/h; 114 mph)
Stalling speed	33 kt (62 km/h; 38 mph)
Max rate of climb at S/L	335 m (1,100 ft)/min
T-O run	139 m (455 ft)
Range	338 n miles (627 km; 390 miles)
g limits	+4/-2

FLYING CONTROLS: Conventional and manual. Split flaps. Flight-adjustable trim tab in starboard elevator. Aileron, flap and elevator activation by carbon-reinforced pushrods; rudder by cables; trim tabs by Bowden cable.



KLN VL-3 cockpit

1159003



KLN VL-3 fixed gear prototype

1159004

STRUCTURE: Fuselage of sandwich shell with transverse bulkheads; engine bolted to sandwich firewall. Carbon fibre engine cowlings; cockpit of hybrid carbon-Kevlar for additional strength; acrylic canopy; carbon sandwich rear fuselage. Hollow wing spars of carbon fibre; ribless wings with integral wingroot fuel tanks; individual wings connected by spar extensions pinned together, the whole attached to fuselage by two pins; ailerons and flaps attached to secondary spars. Empennage comprises tailplane and integral fin; tailplane construction and attachment as for wings.

LANDING GEAR: Tricycle type; retractable or fixed. Hydraulic retraction; all units retract rearwards; emergency hand-pump. Mainwheels 14x4 (4.00-6); nosewheel 12x4. Fuselage-mounted, spring GRP cantilever mainwheel legs; compressed rubber nosewheel shock-absorber. Hydraulic brakes. Wheel fairings on fixed gear version.

POWER PLANT: One Rotax flat-four piston engine; 59.6 kW (79.9 hp) 912 UL or 73.5 kW (98.6 hp) 912 ULS. Two-blade, fixed- or Woodcomp Kremen SR3000 variable-pitch (electric) propeller. Fuel in wingroot tanks; total capacity 90 litres (23.8 US gallons; 19.8 Imp gallons).

ACCOMMODATION: Two persons, side-by-side; baggage stowage to rear. Forward-hinged, single-piece canopy/windscreen; rear window each side.

SYSTEMS: Electrical system 12 V, with 14 Ah battery.

DIMENSIONS, EXTERNAL:

Wing span	8.44 m (27 ft 8¼ in)
Length overall	6.24 m (20 ft 5¾ in)
Height overall	2.05 m (6 ft 8¾ in)

AREAS:

Wings, gross	9.77 m ² (105.2 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty, retractable gear	301 kg (664 lb)
Max T-O weight: Ultralight	450 kg (992 lb)
VLA	560 kg (1,234 lb)

PERFORMANCE (Ultralight: Rotax 912 ULS engine):

Never-exceed speed (VNE)	162 kt (300 km/h; 186 mph)
Max level speed	151 kt (280 km/h; 174 mph)
Normal cruising speed	113 kt (210 km/h; 130 mph)
Stalling speed	36 kt (65 km/h; 41 mph)
Max rate of climb at S/L	365 m (1,200 ft)/min

KUBICEK

BALONY KUBICEK SPOL S.R.O. (KUBICEK BALLOONS LTD)

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Fax: (+420 5) 45 42 26 21

e-mail: sales@kubicekballoons.cz

Web: www.kubicekballoons.cz

OWNER: Dipl Ing Aleš Kubíček

MANAGING DIRECTOR: Dipl Ing Radim Poláček

SALES MANAGER: Michael Suchý

First Kubíček hot-air balloon was manufactured in 1983 and was followed by about 50 more of Kubíček design by various state-owned companies such as Aviatik and Aerotechnik. Present company was formed as private enterprise in 1991 and began new range of hot-air balloons under BB series designations (total of 420 produced by December 2005). Currently markets standard, ready-to-fly balloon systems (including baskets, banners and other equipment) in 13 envelope sizes or types from 1,200 m³ (42,380 cu ft) to 8,500 m³ (300,175 cu ft); also special-shape balloons to order. Own polyester fabric for these is produced by sister company, Kubíček Textil. Workforce of 27 in early 2006, in factory area of 1,400 m² (15,069 sq ft).

Kubíček's first hot-air airship design was the AV-1. A new design, the AV-2, made its maiden flight in 1999. AV-1 continues to be operated in Russia by Avgur and RosAeroSystems, still with its original Kubíček polyester envelope, having now exceeded 950 hours and 1,000 flights. Registered as RF-000032R *Eagle Owl* and piloted by Nikola Galkin, it established a new FAI BX-04 class duration record of 6 hours 1 minute at Dmitrov, Russia, on 20 February 2004. The same aircraft, crewed by Natalia Volodicheva and Ekaterina Kochetkova, set two women's BX-04 records during February 2005: for speed over a 1 km course (9.1 kt; 16.9 km/h; 10.5 mph) on 7 February, and duration (3 hours 22 minutes 44 seconds) on 24 February, both at Zhukovsky.

Development and marketing of airships suspended in 2005 due to increased demand for balloons (667 sold in that year, a company record), but AV-2 being developed and marketed again in 2006.

KUBICEK AV-2

TYPE: Hot-air non-rigid/airship.

PROGRAMME: First flight 26 May 1999; public debut (c/n 106/OK-8036) June 1999; then sold to Reprox Kosice in Slovak Republic as OM-ADS, though returned to factory in 2003 for resale. In September 2004, was owned by Dirigible Atlantic Airship SL, operating on advertising activities in Spain.

COSTS: USD35,000 (2003).

STRUCTURE: Envelope of PES proprietary fabric, with rip panel and safety valves; unbraced, air-filled tail surfaces. All-metal (welded chromoly steel tube) frame, laminated plastics skin gondola.



Kubicek AV-2 flying for a Spanish sponsor

1044870

LANDING GEAR: Tricycle type, with twin nosewheels; fixed.

POWER PLANT: One 34.0 kW (45.6 hp) Rotax 503 UL-2V engine and Avia V-230C two-blade wooden pusher propeller. Fuel tank beneath centre seat, capacity 30 litres (7.9 US gallons; 6.6 Imp gallons).

ACCOMMODATION: Pilot and two passengers.

AVIONICS: Commis; Icom A3E 760-channel VHF radio.

Flight: Garmin 12XL nav receiver.

Instrumentation: Flytec 3040 instrument pack.

DIMENSIONS, EXTERNAL:

Envelope: Length	38.00 m (124 ft 8 in)
Max diameter	14.20 m (46 ft 7 in)
Gondola: Length	3.00 m (9 ft 10 in)
Max width	1.70 m (5 ft 7 in)
Max height	1.85 m (6 ft 0¾ in)

DIMENSIONS, INTERNAL:

Envelope volume	3,500 m ³ (123,601 cu ft)
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AREAS:

Display area (each side)	100.0 m ² (1,076.4 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	440 kg (970 lb)
Fuel weight	20 kg (44 lb)
Max T-O weight	870 kg (1,918 lb)

PERFORMANCE (Rotax 503):

Max level speed	10.5 kt (20 km/h; 12 mph)
Pressure ceiling (estimated)	2,440 m (8,000 ft)
Endurance	1 h 30 min to 2 h

LARUS

LARUS

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e-mail: Ludovit.packo@volny.cz;

Web: www.larus-czech.cz

CHIEF DESIGNER: Ludovit Packo

The Larus is the company's first product.

LARUS LARUS

English name: Gull

TYPE: Side-by-side ultralight.

PROGRAMME: Design work started 1991; prototype (OK-EUC 01) made first flight 22 October 1997. A second prototype has also flown. Will be certified in both ultralight and VLA categories.

DESIGN FEATURES: Typical small lightplane low-wing configuration. Wing sections NACA 2305 at root, NACA 2312 at tip.

FLYING CONTROLS: Conventional and manual. Horn-balanced rudder and one-piece elevator; central trim tab in elevator. Flaps fitted.

STRUCTURE: Mainly composites fuselage and wooden wings with single spar.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring cantilever main units; castoring nosewheel.

POWER PLANT: One 70.8 kW (95 hp) Aero Max 2400 piston engine; two-blade propeller. Fuel capacity 40 litres (10.6 US gallons; 8.8 Imp gallons).

ACCOMMODATION: Pilot and passenger seated side by side. Doors open forwards. Baggage compartment behind seats.



Prototype Larus OK-EUC 01

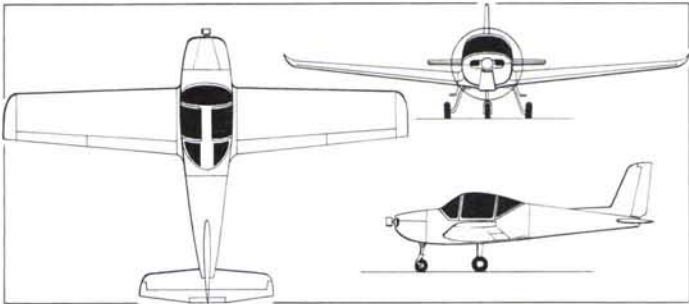
0576232

DIMENSIONS, EXTERNAL:

Wing span	9.80 m (32 ft 1¾ in)
Length overall	6.30 m (20 ft 8 in)
Height overall	2.80 m (9 ft 2¼ in)

AREAS:

Wings, gross	12.86 m ² (138.4 sq ft)
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Larus two-seat ultralight (James Goulding) 0121274

WEIGHTS AND LOADINGS:	
Weight empty	305 kg (672 lb)
Max T-O weight	450 kg (992 lb)
PERFORMANCE:	
Max level speed	124 kt (230 km/h; 143 mph)
Cruising speed	94 kt (175 km/h; 109 mph)
Stalling speed, flaps down	38 kt (70 km/h; 44 mph)
Max rate of climb at S/L	330 m (1,083 ft)/min
Service ceiling	3,000 m (9,840 ft)
T-O to 15 m (50 ft)	250 m (820 ft)
Landing from 15 m (50 ft)	280 m (919 ft)

LD AVIATION

LD AVIATION PRAGUE S.R.O.
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Web: www.ldap.cz
MANAGING DIRECTOR: Jaroslav Najman

LD Aviation was created in 1994 as a joint venture by Letecké Opravy Kbely, Prague Aviation and US-based Duncan Aviation, being known as LOK-Duncan Aviation until US shareholder bought out in October 2000. Current company is owned 34 per cent by Letecké Opravy Kbely and 66 per cent by Czech Aviation Sales.
Company expanded its diversified aviation sales and support business by acquiring the rights to produce uncertified versions of Björn Andreasson's MFI-9 lightplane (Saab retaining rights to certified aircraft).

LD AVIATION MFI 9UL1

TYPE: Side-by-side ultralight
PROGRAMME: Andreasson BA-7 first flew 10 October 1958; developed by Malmö Flygindustri in slightly modified form as MFI-9 Junior (first flight 17 May 1961); MFI-9B Trainer; and combat-capable Mil Trainer — nine of last-mentioned being used operationally in Biafran war of independence. 1969. Bölkow (MBB) of Germany acquired licence in July 1961, building MFI-9 as Bö 208 Junior (first flight April 1962) until 1971. All had 74.6 kW (100 hp) Continental O-200-A engine. Saab acquired NFI in 1968 and built enlarged MFI-15 and MFI-17, latter remaining in production in Pakistan as PAC Mushshak. For some years, amateur builders' plans continued to be sold by Mr Andreasson, with kits available from Cana Aircraft Company of Singapore.
LD Aviation transferred original drawings to CATIA programme and introduced modified nose shape (some 12 cm; 4¾ in) longer than original to maintain C of G with lighter Rotax engine. Lightened structure, saving 45 kg (99 lb). Prototype (OK-JUU 55) first flew 24 November 2004; second aircraft was under construction in 2005 with longer (8.02 m; 26 ft 3¾ in) Bö 208C-style wings and enlarged ailerons. However, by 2006 there was no indication of continuing development or promotion.

LET-MONT

LET-MONT S.R.O.
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DIRECTORS:
Petr Podeřva
Jaroslav Podeřva
BUSINESS MANAGER: Tomáš Podeřva

Aircraft formerly detailed under this heading are now produced by Podeřva.

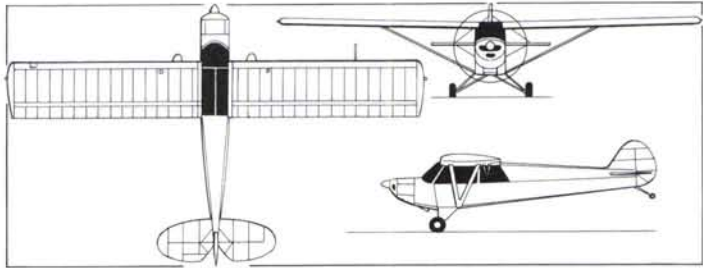
MARA WING

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e-mail: marawing@seznam.cz
Web: www.sweb.cz/marawing

Mára Wing L-1 Malamut (also known as I-L) is distributed by Urban Air s.r.o.

MARA WING L-1 MALAMUT

TYPE: Tandem-seat ultralight.
PROGRAMME: Prototype (OK-IUG 10) flying by 2003. Name derived from a breed of sturdy, Alaskan dog.
COSTS: EUR90,000, plus tax, excluding instruments (2005).
DESIGN FEATURES: Constant-chord, high-mounted wings braced to lower longerons by streamlined V struts; rounded fin. Deep fuselage. Tailplane braced to lower longerons by V struts and to fin by wires.
FLYING CONTROLS: Conventional and manual. Horn-balanced elevators and plain rudder with flight-adjustable tab to port. Cable-actuated, three-stage Fowler flaps. Ailerons and elevators actuated by pushrods; rudder by cables.



Mára Wing L1 Malamut tandem-seat ultralight (James Goulding) 1129167

STRUCTURE: Welded steel tube cockpit cage and riveted rear fuselage with fabric skin. Wing fabric-covered.	
LANDING GEAR: Tailwheel type: fixed; two faired-in side Vs hinged to lower longerons, plus half-axes sprung on centreline with bungee cord. Hydraulic brakes. Mainwheels 9.00-6 (4 ply); solid, steerable tailwheel.	
POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL flat-four driving a Woodcomp two-blade wooden propeller. Optionally 73.5 kW (98.6 hp) Rotax 912 ULS or 59.7 kW (80 hp) Jabiru 2200. Fuel in two wing tanks, combined capacity 80 litres (21.1 US gallons; 17.6 Imp gallons).	
EQUIPMENT: Optional GRS 450 ballistic recovery parachute.	
DIMENSIONS, EXTERNAL:	
Wing span	10.10 m (33 ft 1¾ in)
Length overall	6.80 m (22 ft 3¾ in)
Height overall	2.15 m (7 ft 0¾ in)
AREAS:	
Wings, gross	15.10 m ² (162.5 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	280 kg (617 lb)
Max T-O weight: Ultralight	450 kg (992 lb)
Option	472 kg (1,040 lb)
PERFORMANCE:	
Cruising speed at 80% power	97 kt (180 km/h; 112 mph)
Econ cruising speed at 50% power	81 kt (150 km/h; 93 mph)
Stalling speed	29 kt (52 km/h; 33 mph)
Max rate of climb at S/L	300 m (985 ft)/min
Range	432 n miles (800 km; 497 miles)



Mára Wing Malamut ultralight (Paul Jackson) 1159174

NA DESIGN

NA DESIGN COMPANY INC

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 Tel: (+420 603) 45 44 94
 Fax: (+420 5) 41 26 34 17 and 850 77 41
 e-mail: nadc@nadc.cz
 Web: www.nadc.cz
 CHAIRMAN AND CHIEF DESIGNER: Jan Námisňák
 CUSTOMER SERVICE DIRECTOR: Jaroslav Najman
 GENERAL MANAGER: Jan Oplatek

NA Design was created in third quarter of 1999, in co-operation with Moravan Aeroplanes Inc. Development of the (formerly UNIS) Bongo continued into early 2002, at which time NA Design was seeking a Western partner to assist with certification, production and marketing; the project was put on hold in late 2002 while finance was sought but, despite this, a new version, the four-seat NA50, was announced in late 2002. Some USD2.5 million said to be

required to bring aircraft to production readiness; by 2006, no evidence that this had been raised. Designer Jan Námisňák previously built the Caprice 21 tandem-seat, high-wing pusher lightplane.

NA DESIGN NA 40 BONGO

TYPE: Two-seat ultralight helicopter.

PROGRAMME: Design work 1992 followed by model tests 1993; construction of Bongo technology demonstrator started 1996; public debut at Brno International Machinery Fair 1997 (then called UNIS NA40, and with two-blade main rotor) by first prototype OK-CIU. Began 70 hours of tethered hover flights March 1998. Two further prototypes completed by mid-1998. NA Design plans Normal category certification to FAR Pts 27, 33, 34 and 36 by late 2003, subject to finding joint venture Western partner to share certification, manufacturing and marketing costs. However, by 2002, financial support of USD2.5 million was still being solicited; by March 2003 the company stated that development was continuing and commercial launch was due for 2005; had not occurred by mid-2006.

PODEŠVA

TOMÁŠ PODEŠVA

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 e-mail: t.podesva@cmail.cz
 Web: www.podesva-air.com
 PRESIDENT: Tomáš Podesva

Tomáš Podesva is responsible for the design of the UL Tulák and UL Piper ultralights, previously detailed under Let-Mont.

The company builds and distributes a wide range of ultralight aircraft including the Trener, Dandy (Tulák), Cubby (Piper), Amigo and Chico as well as scale replicas of the Messerschmitt Bf 109 and Bücker C 104. Overseas distribution is handled by a range of companies including HB Flugtechnik of Austria, Aero-Impex of France and Fläming-Air of Germany. The Bf 109 is marketed exclusively by Roland of Germany.

PODEŠVA TRENER BABY

TYPE: Tandem-seat ultralight/kitbuilt.

PROGRAMME: Designed and built as ultralight prototype by Peter Podesva; 80 per cent scale replica of Czechoslovak Zlin 126 Trener (member of Zlin 26 family, which was produced between late 1940s and mid-1970s). Production version built by son, Tomáš Podesva at Hranice; certified and distributed by Fläming Air; second aircraft (OK-FUD 01) exhibited at ILA, Berlin, June 2000. Type certificate awarded 18 February 2003 in Czech Republic, 18 February 2004 in Germany and 4 February 2005 in France.

CURRENT VERSIONS: **Ultralight:** Wooden wings; MTOW limited to 450 kg (992 lb). Also available as kit, meeting '51 per cent rule'.

Experimental: Metal wings; 520 kg (1,146 lb) MTOW; kitbuilt.



Podesva Trener Baby in 'house colours'

1159203

Akro: Version with all-metal wing and tailplane. Fluted aileron skins and split flaps; fabric-covered elevator. Three-piece canopy, plus windscreen, public debut (D-EETB) at Berlin, May 2004.

COSTS: Ultralight: kit EUR41,667; complete example with engine EUR59,524. Experimental: EUR52,530; with retractable landing gear EUR53,372. Akro kit EUR46,578 (all 2006).

DESIGN FEATURES: Low wing with sweptback leading-edge and unswept trailing-edge; mid-mounted, braced tailplane. Replica of Zlin 126 aerobatic trainer to 80 per cent scale, except full-scale cockpit.

FLYING CONTROLS: Conventional and manual. Split flaps. Flight-adjustable tabs on both elevators; ground-adjustable tab on rudder and port aileron.

STRUCTURE: Steel tube fuselage with fabric covering, except for sheet metal upper surface and engine cowlings; fabric-covered empennage. Wings wood or metal, according to version, with aluminium leading-edge and fabric covering. Composites nose fairing.

LANDING GEAR: Tailwheel type; fixed. Wing-mounted, trousered, cantilever sprung main legs. Mainwheels 5.00-5; tailwheel 200x50. Hydraulic brakes.

POWER PLANT: One 55.1 kW (73.9 hp) Walter Mikron III four-cylinder, in-line piston engine driving a Kremen two-blade, variable-pitch (electric), wooden propeller or Woodcomp



Akro version of Podesva Trener Baby

1159204

PROAIR

PROAIR INC

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Web: www.proair.cz

DIRECTOR: Libor Veverka

The Skywalk GL 165 is Proair's first autogyro.

PROAIR SKYWALK

TYPE: Two-seat autogyro ultralight.

PROGRAMME: Prototype (OK-KWA 01) first flew in January 2005 and made public debut at Aero '05, Friedrichshafen, in April 2005.

CURRENT VERSIONS: Skywalk GL 165: Prototype.

Skywalk GL 180: Production version with uprated engine; was due to be manufactured from late 2005.

DESIGN FEATURES: Enclosed autogyro with large, twin fins and tailplane mounted on cantilever boom. Hydraulic prerotation mechanism; hydraulic rotor disc brake.

FLYING CONTROLS: Twin, horn-balanced rudders.

STRUCTURE: Metal keel supporting composites pod containing cockpit and power plant; keel bifurcated at rear to support composites tailplane with fin and rudder at each tip.

LANDING GEAR: Tricycle type; fixed. Keel-mounted spring carbon fibre cantilever mainwheel legs. Tyre size (all) 10x4.50-5; solid tail bumper wheel. Hydraulic disc brakes.

POWER PLANT: One 122 kW (164 hp) piston engine driving a Warp Drive four-blade, ground-adjustable pitch propeller. Fuel capacity 60 litres (15.9 US gallons; 13.2 Imp gallons).

AVIONICS: Single-screen 'glass cockpit'.

ARMAMENT: Optional ballistic parachute recovery system.

DIMENSIONS, EXTERNAL:

Rotor diameter 9.00 m (29 ft 6 1/4 in)

Propeller diameter 1.70 m (5 ft 7 in)

WEIGHTS AND LOADINGS:

Max T-O weight 450 kg (992 lb)

PERFORMANCE:

Never-exceed speed (VNE) 116 kt (216 km/h; 134 mph)

Max level speed 97 kt (180 km/h; 112 mph)

Max cruising speed 81 kt (150 km/h; 93 mph)

Econ cruising speed 54 kt (100 km/h; 62 mph)

Max rate of climb at S/L 180 m (590 ft)/min

Service ceiling 3,000 m (9,840 ft)

T-O run up to 60 m (200 ft)

Landing run up to 20 m (65 ft)



Prototype Proair GL 165 Skywalk (Paul Jackson)

1159173

TEST

TEST S.R.O.

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e-mail: test@info.cz

Web: www.test.info.cz

PRODUCTION DIRECTOR: Zdeněk Těplý

MARKETING DIRECTOR: Zbynek Jaroš

Company was established 1992 to design, develop and produce ultralight sailplanes, powered sailplanes and aircraft; first product was TST-1 Alpin sailplane. Capacity increased to 10 aircraft per year in 1995 and to 40 per year from September 1998. Developed versions of Alpin (TST-3 and TST-8), available in both sailplane and motor glider variants, still form core of production; the TST-5, TST-6 and TST-9 have now been discontinued. Workforce was 17 in 2004.

In October 2002, a further sailplane - the TST-10 Atlas M — was added to the product line, and the company announced that it had started development of the TST-12, a two-seat, low-wing, tailwheel ultralight. In 2004, the TST-14 Bonus M two-seat derivative of the TST-10 was added to the range as the company concentrated on its composites sailplane products.

In 2005, the TST-13 Junior 2005 all-composites successor to the TST-9 was introduced.

TEST TST-13 JUNIOR 2005

TYPE: Single-seat ultralight motor glider.

PROGRAMME: Developed in late 1990s, is a derivative of the earlier TST-9 Junior 2000, itself derived from the TST-7 Junior.

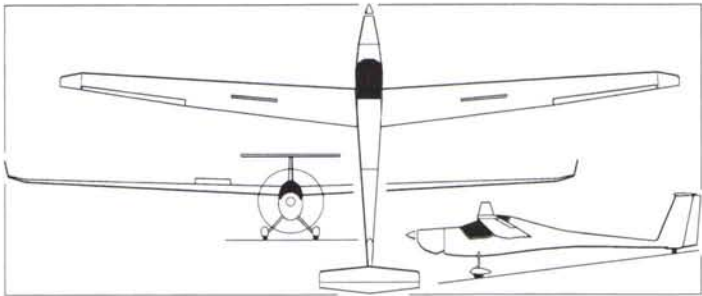


TeST TST-13 Junior 2005 prototype

1159216

DESIGN FEATURES: Forward-swept, high-wing monoplane with T tail. Tailplane removable for storage and transportation. Tailplane aerofoil NACA 0011.

FLYING CONTROLS: Conventional and manual. Ailerons and elevators rod-actuated, rudder by cables. Two position flaps; upper-surface spoilers.



TeST TST-13 general arrangement 1159219

STRUCTURE: Composites wing with I-shaped spar identical to that used on TST-10 glider. Fuselage of sandwich structure with integral empennage. Wing, with plywood and fabric covering; glass fibre wingtips. All-wood fuselage except for glass fibre panel behind cockpit.

LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted spring cantilever mainwheel legs with wheel fairings and 300x100 wheels; 120x30 steerable tailwheel.

POWER PLANT: One 31.0 kW (41.6 hp) Rotax 447 engine and two-blade SportProp 1600 propeller standard; or suitable equivalent; 37.0 kW (49.6 hp) Rotax 503 can also be fitted.

Standard fuel capacity 20 litres (5.3 US gallons; 4.4 Imp gallons); this can be optionally increased to 40 litres (10.6 US gallons; 8.8 Imp gallons) by use of interchangeable wing tank.

EQUIPMENT: Optional BRS parachute.

DIMENSIONS, EXTERNAL:

Wing span 15.00 m (49 ft 2½ in)

Length overall 7.05 m (23 ft 1½ in)

DIMENSIONS, INTERNAL:

Cabin max width 0.59 m (1 ft 11¼ in)

AREAS:

Wings, gross 10.03 m² (108.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 195 kg (430 lb)

Max T-O weight 300 kg (661 lb)

with BRS parachute system 322 kg (709 lb)

PERFORMANCE, POWERED:

Never-exceed speed (VNE), and max speed with spoilers extended 108 kt (200 km/h; 124 mph)

Max cruising speed 86 kt (160 km/h; 99 mph)

Normal cruising speed 65 kt (120 km/h; 75 mph)

Stalling speed 36 kt (65 km/h; 41 mph)

g limits +4.8/-2.8

PERFORMANCE, UNPOWERED:

Best glide ratio at 50 kt (93 km/h; 58 mph) 32

TL

TL ULTRALIGHT

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Formed in 1990, TL previously produced the TL-1, TL-2 and TL-32 ultralights, progressing then to the TL-132, predecessor of the current TL-232. The TL-22 Duo/Eso Rogallo-wing trike is also available. In February 2006 the company opened a new 4,087 m² (44,000 sq ft) factory, at which time it had a workforce of 70 and had delivered over 400 aircraft.

TL-96 STAR and TL-2000 STING CARBON

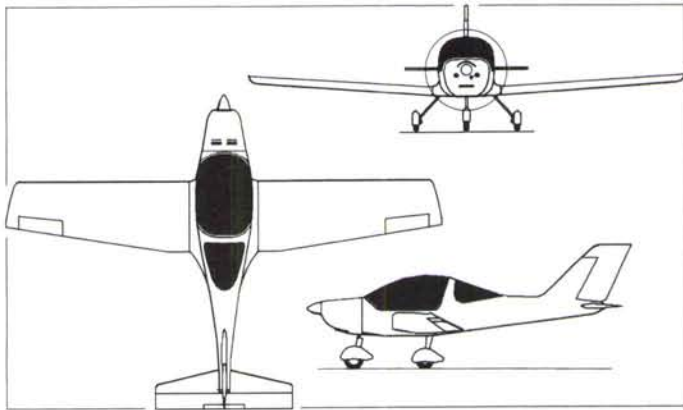
TYPE: Side-by-side ultralight.

PROGRAMME: Prototype Star first flew November 1997.

CURRENT VERSIONS: **TL-96 Star:** Baseline version; as described. Marketed in USA as StarSport, but only demonstrator (N551WA) produced. Low rate production only.

TL-2000 Sting Carbon: All-CFRP version; prototype OK-GUU 10; announced 2000; Czech type certificate issued, 19 December 2002. Marketed in USA as StingSport and received S-LSA approval on 24 May 2005. Retractable gear version shown (prior to first flight) at Aero '03, Friedrichshafen, April 2003. Estimated 15 kt (28 km/h; 17 mph) speed advantage for 3 kg (7 lb) weight penalty. US version has increased weight of 386 kg (851 lb) empty and 648 kg (1,430 lb) max T-O, with Rotax 914 engine.

TL-2000 Sting RG: Retractable landing gear version introduced in 2005, based on TL-2000 Sting Carbon. Mainwheels retract outwards.



TL-2000 Sting two-seat ultralight 1159140

CUSTOMERS: Sales in Australia, Belgium, Canada, Czech Republic, Finland, France, Germany, Hungary, Italy, Japan, Netherlands, New Zealand, Poland, Portugal, South Africa, South Korea, Spain and USA. Production rate set at four per month in 2006. By mid-2006, at least 141 TL-96s and 121 TL-2000s (including RG versions) produced in Europe, while further 50 registered in US. Last-mentioned mostly StingSports, but include two Sting Carbons, two Sting RGs and one each of Sting, Sting XS, Sting Trainer and StarSport.

EQUIPMENT: Optional AmSafe Aviation inflatable restraints available on US aircraft.

COSTS: TL-96 EUR51,000; TL-2000 EUR55,000 (2005).

DESIGN FEATURES: Conventional, low-wing monoplane with constant-chord wings and tailplane, plus sweptback fin.

MS 313 wing aerofoil section. Optional tailcone extension for towing hook.

FLYING CONTROLS: Manual. All-moving tailplane with anti-balance tab. Three-position (0, 15, 35°) split flaps.

STRUCTURE: All-composites (GFRP and CFRP).

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring GFRP cantilever legs and wheel fairings. Steerable nosewheel. Tyre sizes 4.00-8/400x100 (main), 4.00-4 (nose). Hydraulic mainwheel brakes.

POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL-DCDI or 84.6 kW (113.4 hp) Rotax 914 flat-four engine; three-blade Albastar propeller. Optional 67.1 kW (90 hp) Aero Prag AP-45 flat-four and two-blade wooden propeller. Fuel capacity (RON 95) 67 litres (17.7 US gallons; 14.7 Imp gallons) in TL-96 and TL-2000, optionally 100 litres (26.4 US gallons; 22.0 Imp gallons) in fuselage tank and two 30 litre (7.9 US gallon; 6.6 Imp gallon) wing tanks.



TL-2000 StingSport LSA version for US market (Paul Jackson) 1159144

ACCOMMODATION: Heated as standard.

DIMENSIONS, EXTERNAL (A: TL-96, B: TL-2000):

Wing span: A	9.20 m (30 ft 2 1/4 in)
B	8.44 m (27 ft 8 1/4 in)
Length overall: A	6.50 m (21 ft 4 in)
B	5.93 m (19 ft 5 1/2 in)
Height overall: A, B	2.30 m (7 ft 6 1/2 in)

DIMENSIONS, INTERNAL:

Cabin max width: A, B	1.02 m (3 ft 4 1/4 in)
-----------------------	------------------------

AREAS:

Wings, gross: A	12.20 m ² (131.3 sq ft)
B	9.08 m ² (97.7 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: A	285 kg (628 lb)
B	275 kg (606 lb)
Max T-O weight: A, B	450 kg (992 lb)
B, where permitted	598 kg (1,320 lb)

PERFORMANCE, POWERED (Rotax 912):

Never-exceed speed (VNE):	
A	148 kt (275 km/h; 170 mph)
B	164 kt (305 km/h; 189 mph)
Max level speed: A	138 kt (255 km/h; 158 mph)
B	145 kt (270 km/h; 167 mph)
Max cruising speed: A	119 kt (220 km/h; 137 mph)
B	140 kt (260 km/h; 162 mph)
Stalling speed: A	34 kt (63 km/h; 40 mph)
B	36 kt (65 km/h; 41 mph)
Max rate of climb at S/L: A	300 m (984 ft)/min
B	480 m (1,575 ft)/min
Range: A	540 n miles (1,000 km; 621 miles)
B	810 n miles (1,500 km; 932 miles)

PERFORMANCE, UNPOWERED:

Best glide ratio: A	16
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TL-232 CONDOR

TYPE: Tandem-seat ultralight/kitbuilt.

PROGRAMME: Side-by-side seat TL-132 (Rotax 503 engine) first flown 1993; entered production, and TL-232 introduced, in 1994. TL-132 subsequently discontinued.

CURRENT VERSIONS: **TL-232 Condor Plus**: Compared to TL-132, has modified wing profile; option of more powerful engine; cut-down rear fuselage and additional glazing for rear cockpit.

Power Condor: Version with 73.5 kW (98.6 hp) Rotax 912 ULS and glider-towing equipment; able to aero-tow sailplanes of up to 400 kg (882 lb) AWW.

Condor S: Aerotowing version, certified 23 October 2001. Prototype (D-MPAK) fitted with Hirth fuel-injected engine.

CUSTOMERS: Operators in Czech Republic, Germany, Netherlands, Poland and Sweden. Total of 320 sold by November 2004. Promotion was continuing in 2006.

COSTS: Kit only EUR21,010; with Rotax 582 UL-DCDI EUR38,000; Rotax 912 UL EUR47,700; Rotax 912S UL EUR58,800 (all 2003).

DESIGN FEATURES: Constant-chord, high wing with V-strut bracing; mid-mounted tailplane; sweptback fin with long fillet. Wings and horizontal tail surfaces foldable for transportation and storage.

FLYING CONTROLS: Conventional and manual. In-flight-adjustable tab in starboard elevator. Two-position flaps. Dual controls.

STRUCTURE: Fabric-covered metal. Composites rear top-decking.

LANDING GEAR: Tricycle type; fixed (tailwheel version discontinued). Fuselage-mounted spring cantilever mainwheel legs with wheel fairings. Tyre sizes 16x4 (main), 400x100 (nose). Hydraulic brakes. Leg and wheel speed fairings optional.

POWER PLANT: One 47.8 kW (64.1 hp) Rotax 582 UL-DCDI two-cylinder two-stroke in-line engine in basic TL-232, driving a three-blade Albastar ground-adjustable pitch propeller. Optional alternatives include 59.6 kW (79.9 hp) Rotax 912 UL-DCDI or 73.5 kW (98.6 hp) Rotax 912 ULS flat-four with Ivoprop three-blade composites propeller. Fuel capacity 50 litres (13.2 US gallons; 11.0 Imp gallons) standard, 62 litres (16.4 US gallons; 13.6 Imp gallons) optional.

DIMENSIONS, EXTERNAL:

Wing span	10.60 m (34 ft 9 1/4 in)
Length overall	5.90 m (19 ft 4 1/4 in)
Height overall	2.30 m (7 ft 6 1/2 in)

AREAS:

Wings, gross	14.84 m ² (159.7 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	265–280 kg (584–617 lb)
Max T-O weight	450 kg (992 lb)

PERFORMANCE (Rotax 912 UL-DCDI engine):

Max level speed	97 kt (180 km/h; 111 mph)
Cruising speed	81 kt (150 km/h; 93 mph)
Stalling speed	33 kt (60 km/h; 38 mph)
Max rate of climb at S/L	276 m (906 ft)/min



TL Ultralight TL-232 Condor Plus

1042745

URBAN

URBAN AIR S.R.O.

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DIRECTOR: Pavel Urban

SALES MANAGER: Ing Milos Mladek

This company produces the UFM-10 Samba and UFM-13 Lambáda ultralight at its three factories in the area of Usti nad Orlici.

URBAN UFM-13 LAMBÁDA

TYPE: Side-by-side ultralight/kitbuilt.

PROGRAMME: Design started June 1994; first flight (UFM-11 prototype) 23 May 1996; production began October 1996; first customer delivery October 1997.

CURRENT VERSIONS: **UFM-11 UK**: Short-span (11.80 m; 38 ft 8 1/2 in) version. Production discontinued in 2000, but restarted in 2003, featuring two-position slotted flaps as fitted to UFM-10.

UFM-13: Standard version, as described. Optional wingtips to extend span from 13 to 15 m (UFM-13/15). Also available as sailplane (**UFM-13W**) with single mainwheel.

A UFM-13/15 (D-MZGG) shown at Berlin in May 2002 featured a Hirth fuel-injected engine and Hoffmann HO-V62R two-blade, variable pitch, metal propeller.

CUSTOMERS: Total 17 factory-built UFM-11s and 68 UFM-13s built by late 2005, exported to Brazil, Estonia, France, Germany, Ireland, Netherlands, South Africa, Spain, Switzerland and USA.

COSTS: Flyaway, excluding VAT, EUR47,300 (2004).

DESIGN FEATURES: Conforms to JAR-VLA. Forward-swept wings with cranked leading-edge and laminar profile (aerofoil section SM 701); incidence 3°. T tail. Wings and horizontal tail detach for storage and transportation.

FLYING CONTROLS: Conventional (manual) three-position (5, 9, 16°) flaperons, rudder and one-piece elevator; upper surface Schempp-Hirth spoilers. Ailerons and slotted flaps on UFM-11.

STRUCTURE: Laminated glass fibre and carbon fibre, with CFRP wing spar.

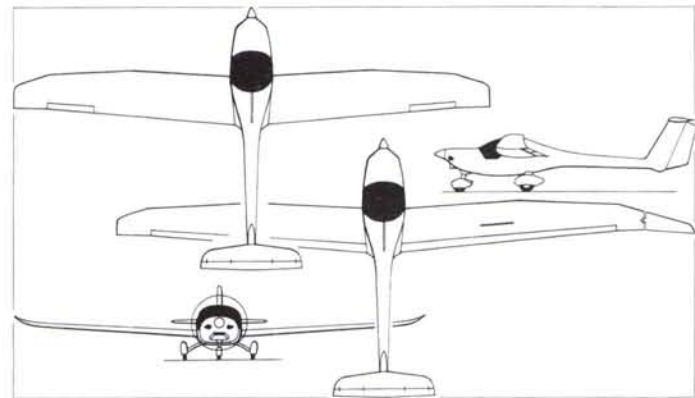
LANDING GEAR: Fixed; tricycle or tailwheel type. Fuselage-mounted spring cantilever mainwheel legs with wheel fairings and hydraulic brakes. Mainwheel tyres 4.00–8.

POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL, 73.5 kW (98.6 hp) Rotax 912 ULS or 59.7 kW (80.0 hp) Jabiru 2000 four-stroke engine; driving SportProp two-blade, glass fibre (Rotax) or Kremen three-blade, wooden (Jabiru) propeller. Fuel tank in port wing, capacity 50 litres (13.2 US gallons; 11.0 Imp gallons); second identical tank can be fitted into starboard wing.



Urban UFM-11 Lambáda (Paul Jackson)

1159145



Urban UFM-11 Lambáda, with additional plan view of UFM-13 showing UFM-15 wingtip to starboard (Paul Jackson)

1159139

DIMENSIONS, EXTERNAL:	
Wing span: standard	13.00 m (42 ft 7¾ in)
extended	15.00 m (49 ft 2½ in)
Length overall	6.60 m (21 ft 7¾ in)
Height overall	1.95 m (6 ft 4¾ in)
DIMENSIONS, INTERNAL:	
Cabin max width	1.06 m (3 ft 5¾ in)
AREAS:	
Wings, gross: standard span	12.16 m² (130.9 sq ft)
extended span	12.85 m² (138.3 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty: standard span	265 kg (582 lb)
extended span	280 kg (617 lb)
Max T-O weight: both	472.5 kg (1,041 lb)
PERFORMANCE, POWERED (Rotax 912 UL):	
Never-exceed speed (VNE)	108 kt (200 km/h; 124 mph)
Max cruising speed	81 kt (150 km/h; 93 mph)
Stalling speed	35 kt (63 km/h; 40 mph)
Max rate of climb at S/L	300 m (984 ft)/min
Range	432 n miles (800 km, 497 miles)
PERFORMANCE, UNPOWERED:	
Best glide ratio: standard wing	26
extended wing	30
Min rate of sink	1.10 m (3.61 ft)/s

URBAN UFM-10 SAMBA

TYPE: Side-by-side ultralight/kitbuilt.
PROGRAMME: Previously known as Speed Lambáda, Prototype OK-EUU 38 rolled out July 1999; first production aircraft (OK-EUU 39) flew 21 July 1999.
CURRENT VERSIONS: **UFM-10 Samba**: As described.

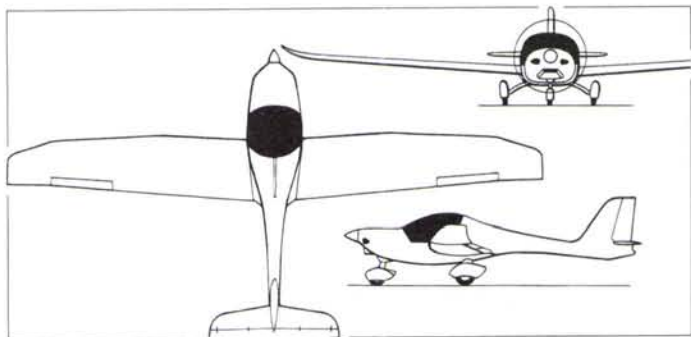
UFM-10 Samba XXL: Introduced in 2003. Superficially similar to standard Samba, but has redesigned carbon fibre fuselage and empennage. Cockpit section is from ATEC Zephyr, and Samba XXL is thus broadly in parallel to FSU Saphir, marketed by Flaming Air of Germany. Wing maintains 10.00 m (32 ft 9¾ in) span. Fuselage length increased by 10 cm (4 in); height 2.20 m (7 ft 2½ in), due to redesigned, longer landing gear legs. MTOW 472.5 kg (1,041 lb) as parachute-equipped Ultralight, or 520 kg (1,146 lb) in Experimental category. Weight 260 kg (573 lb); cruising speed 119 kt (220 km/h; 137 mph); max speed 146 kt (270 km/h; 168 mph). Other differences from standard Samba include front-hinged canopy, winglets and fin fillet. Third prototype (OK-IUA 54) was first to fly – on 15 April 2003.

CUSTOMERS: Total of at least 41 Sambas produced by late 2004, including examples to Germany, Ireland, Netherlands, South Africa, Swaziland and USA; none known in 2005 or early 2006. At least 31 Samba XXLs sold by early 2006 to customers in South Africa, Norway and Czech Republic.



Urban Samba XXL with optional winglets (Paul Jackson)

1159146



Urban UFM-10 Samba (Paul Jackson)

1159138

COSTS: EUR47,300 excluding VAT (2004).	
DESIGN FEATURES: Short-span version of UFM-13; low-mounted wing and tailplane; shorter wheelbase. Suitable as tug for sailplanes of up to 380 kg (837 lb) MTOW.	
FLYING CONTROLS: Conventional and manual. Balanced ailerons. Two-position (20 and 45°) slotted flaps.	
POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL or 73.5 kW (98.6 hp) Rotax 912 ULS flat-four, driving two- or three-blade, ground-adjustable pitch propeller as per UFM-13. Motor Design 63.0 kW (84.5 hp) MD 90 Diesel engine as option from 2005. Fuel capacity 50 litres (13.2 US gallons; 11.0 Imp gallons) in port wing tank; second tank can be fitted to starboard wing.	
EQUIPMENT: BRS recovery parachute and glider-towing equipment optional.	
DIMENSIONS, EXTERNAL:	
Wing span: normal	10.00 m (32 ft 9¾ in)
option	13.00 m (42 ft 7¾ in)
Length overall	5.90 m (19 ft 4¼ in)
Height overall	1.95 m (6 ft 4¾ in)
AREAS:	
Wings, gross	8.90 m² (95.8 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty: standard	250 kg (551 lb)
with parachute and hook	286 kg (630 lb)
Max T-O weight: standard	472.5 kg (1,041 lb)
with parachute and hook	520 kg (1,146 lb)
PERFORMANCE, POWERED (Rotax 912 UL):	
Never-exceed speed (VNE)	140 kt (260 km/h; 161 mph)
Normal cruising speed	108 kt (200 km/h; 124 mph)
Stalling speed: flaps down	36 kt (65 km/h; 41 mph)
Max rate of climb at S/L	300 m (984 ft)/min
PERFORMANCE, UNPOWERED:	
Best glide ratio	19
Min rate of sink	1.50 m (4.92 ft)/s

WOLFSBERG LETOV

WOLFSBERG LETECKÁ TOVARNA S.R.O.
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CEO: Alex Bolek
CHIEF ENGINEER: Sergei Orlov
CHIEF DESIGNER: Alec Clark

Company formed from part of former Letov, established in 1918 and privatised in mid-1990s as separate divisions, including Letov Letecká Výroba, Letov Simulator, Letov Nastrojana and Letov Air. Following 1998 bankruptcy of Letov group, Letov Letecká Výroba (Letov Aircraft Production) was sold by administrator on 1 June 2000 to Latécoère of France and continued with manufacture of aerostructures, while Letov Air became a wholly owned subsidiary of Wolfsberg Aircraft Corporation of Belgium as (initially) Letecká Tovarna ('Aircraft Factory', abbreviated to Letov), having discontinued production of ultralight aircraft (LK-2, LK-3 and ST-4).

On 21 November 2000, it was announced that Letecká Tovarna had been assigned design and production responsibility for the Wolfsberg Raven 257 (now Corvus 1) cargo aircraft, taking over from Evektor-Aerotechnik, another Czech firm. Marketing and financing is the responsibility of the Belgian company. Following a major reorganisation of management in 2003, the company began restructuring under the name of Wolfsberg. Current activities include production of sheet metal parts and sub-assemblies for Aero Vodochody, Ibis Ae 270, Evektor EV-96, Pilatus PC-6 Porter and parts for emergency doors of Airbus aircraft.

WOLFSBERG CORVUS 1

TYPE: Light utility twin-prop transport.
PROGRAMME: Definitive design began in June 1997; then known as Raven 257. Wings and tail surfaces of prototype made by Letov Air in Prague; rest of aircraft and flight testing assigned to Evektor-Aerotechnik in Kunovice, Czech Republic. First flight (OK-RAV) 28 July 2000. Original date set for certification to FAR Pt 23 was April 2002, but this postponed when prototype found to be 400 kg (881 lb) overweight and collaboration with Evektor was terminated.
Design and manufacture transferred back to Letov Air in September 2000. Some major structural modifications were carried out to prototype, increases in wing span and MTOW; and forward port and starboard doors repositioned to provide direct access to flight deck. Letov was, meanwhile, acquired by Wolfsberg. Production of the conforming prototype and structural test aircraft was proceeding in late 2003/early 2004 after reorganisation and changing the name of the company to Wolfsberg Letecká Tovarna s.r.o.

Redesigned aircraft was relaunched as Corvus 1 in 2005. Prototype (OK-WLT) first flew at Praha-Kbely, 6 June 2006.

CURRENT VERSIONS: **Corvus 1F:** Freight version. May be converted to Corvus 1P with modification kit. *As described.*

Corvus 1P: Passenger version. May be converted to Corvus 1F with modification kit. Empty weight 2,020 kg (4,453 lb); pilot and nine passengers (one in cockpit), plus 80 kg (176 lb) baggage in tailcone. Range 800 n miles (1,481 km; 920 miles) with full load and full fuel.

COSTS: USD885,000 (2006).
DESIGN FEATURES: High-wing, twin-boom configuration with square section fuselage and high-set tailplane. Design goals include ability to operate from short unprepared strips, simple systems and easy field maintenance for operation in less-developed areas, combined with low acquisition and operating costs; seen as modern replacement for aircraft in the B-N Islander and Piper Aztec class, and as a 'step up' for operators of single-engined utility aircraft such as the Cessna 206, with applications in passenger, cargo, medevac and airdrop roles.

NACA 23018 section wings, with 2° 30' dihedral; 3° incidence; NACA 0012 section horizontal and vertical tail surfaces.

FLYING CONTROLS: Conventional and manual, via push-pull rods. Control surfaces statically balanced. Two-section elevator with independent controls and trim tab on port side. Maximum elevator deflection +27°-22°, aileron deflection +25°-15°; rudder deflection ±25°. Trim tab on starboard rudder. Four-section electrically actuated flaps, T-O setting 20°, landing 48°.

STRUCTURE: Conventional, mostly riveted aluminium alloy, with glass fibre wingtips, nosecone, cargo hatch and engine cowlings.

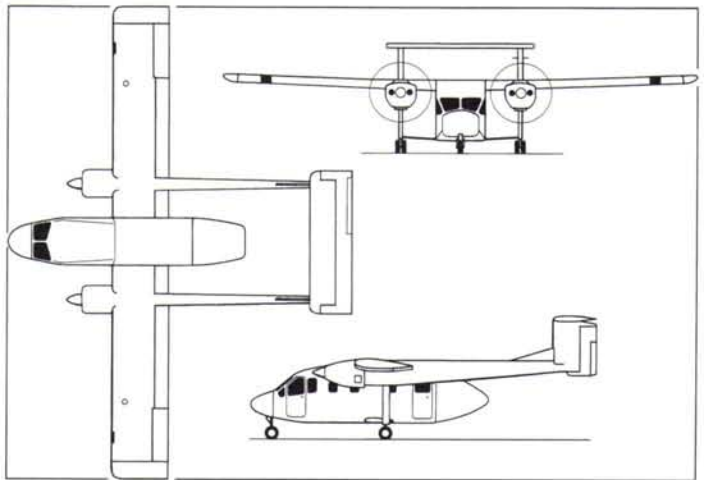
LANDING GEAR: Tricycle type; fixed. Based on, and mostly interchangeable with, that of B-N Islander, with main legs mounted outboard, beneath tailboom/wing intersection and braced to lower fuselage by streamline section horizontal strut; twin wheels on each main unit and single nosewheel; oleo strut suspension. Mainwheel tyre size 7.00-6; nosewheel 6.00-6; Cleveland 40-90F brakes on mainwheels; 40-76D on nosewheel.

POWER PLANT: Two 231.2 kW (310 hp) Teledyne Continental IO-550-N8B flat-six engines, driving two-blade constant-speed propellers. Fuel contained in two integral tanks in outer wings, combined capacity 660 litres (174 US gallons; 145 Imp gallons), of which 640 litres (169 US gallons; 141 Imp gallons) usable; filler port in upper surface of each wing.



Prototype Wolfsberg Corvus 1F rear aspect

1159082



Wolfsberg Corvus 1 utility aircraft (Paul Jackson)

1154395

ACCOMMODATION: Two-crew on 26 g seats (although aircraft will be certified for single-pilot operation); up to eight passengers, or combi configuration with four passengers and 500 kg (1,102 lb) of cargo. Crew door on each side; sliding semi-bulkhead separates flight deck from cabin/cargo area, which has flat floor and quick-change features including four floor attachment rails, with passenger door at rear on port side and upward-hinged rear cargo door. In cargo configuration, fuselage can accommodate 304 × 139 cm pallets, 1.2 × 1.0 m Europallets and bulk cargo under netting. Baggage door on port side, emergency exit on starboard side. Max floor loading 730 kg/m² (150 lb/sq ft).

SYSTEMS: 24 V electrical system includes two engine-driven 100 A alternators and 24 V 19 Ah accumulator. Optional features include pneumatic leading-edge de-icing; electric propeller and windscreens anti-icing; air conditioning; and autopilot.

AVIONICS: Bendix/King equipment.

Comms: Twin KX 155 nav/com/glideslope; KT 70 Transponder. Optional ELT.

Nav: KN 62A DME; KR 87 ADF with KI 227 indicator. Optional GPS.

Data refer to production version.

DIMENSIONS, EXTERNAL:

Wing span	15.40 m (50 ft 6¼ in)
Wing chord, constant	1.85 m (6 ft 0¾ in)
Wing aspect ratio	8.3
Length overall	11.30 m (37 ft 1 in)
Height overall	3.95 m (12 ft 11½ in)
Tailplane span	4.80 m (15 ft 9 in)
Wheel track	4.00 m (13 ft 1½ in)
Wheelbase	3.86 m (12 ft 8 in)
Propeller diameter	1.98 m (6 ft 6 in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck: Length	3.99 m (13 ft 1 in)
Max width	1.48 m (4 ft 10¼ in)
Max height	1.48 m (4 ft 10¼ in)
Volume	8.74 m³ (309 cu ft)

AREAS:

Wings, gross	28.45 m² (306.2 sq ft)
Ailerons (total)	1.48 m² (15.93 sq ft)
Trailing-edge flaps (total): inner	1.06 m² (11.41 sq ft)
outer	1.60 m² (17.22 sq ft)



Wolfsberg Corvus 1F prototype on its maiden flight, 6 June 2006

1159081



Front view of Wolfsberg Corvus 1F prototype

1159083

Tailplane	4.54 m ² (48.87 sq ft)	Cruising speed at 75% power	133 kt (246 km/h; 153 mph)
Elevators, incl tabs	3.36 m ² (36.17 sq ft)	Econ cruising speed	120 kt (222 km/h; 138 mph)
Fin (total)	3.84 m ² (41.33 sq ft)	Stalling speed	61 kt (113 km/h; 71 mph)
Rudders (total)	2.36 m ² (25.40 sq ft)	Max rate of climb at S/L	335 m (1,100 ft)/min
WEIGHTS AND LOADINGS:		Service ceiling	5,000 m (16,400 ft)
Weight empty	1,950 kg (4,299 lb)	Service ceiling, OEI	1,860 m (6,100 ft)
Max fuel weight	475 kg (1,047 lb)	T-O run	145 m (475 ft)
Max T-O and landing weight	3,100 kg (6,834 lb)	T-O to 15 m (50 ft)	330 m (1,085 ft)
Max zero-fuel weight	3,000 kg (6,613 lb)	Landing from 15 m (50 ft)	440 m (1,445 ft)
Max wing loading	109.0 kg/m ² (22.32 lb/sq ft)	Landing run	170 m (560 ft)
Max power loading	6.71 kg/kW (11.02 lb/hp)	Range: with max fuel and 560 kg (1,234 lb) payload	810 n miles (1,500 km; 932 miles)
PERFORMANCE (estimated):		with 950 kg (2,094 lb) payload	140 n miles (259 km; 161 miles)
Max level speed	148 kt (274 km/h; 170 mph)		

ZLIN

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MARKETING: Eva Buresová

Formed 18 September 1934 as Zlinská Letecká Akciová Společnost (Zlin Aviation Company Ltd) in Zlin; manufacture of Zlin aircraft started 1933 by Masarykova Letecká Liga (Masaryk League of Aviation); total of approximately 650 aircraft, including gliders and military transports, manufactured by end of Second World War.

Company then renamed Moravan; post-war aircraft production included 1,495 of the Z 26 family (162 Z 26, 170 Z 126, 366 Z 226, 436 Z 326, 331 Z 526 and 30 Z 726) built between 1949 and 1975. Production began in 1970 of Z 42/142/242 and Z 43/143 families; Algerian Z 43s (five supplied in 1991) designated **Safir 43**; Algerian Z 142s (17 complete and 29 kits in 1987-91) designated **Firnas 142**. In July 1997, the factory suffered serious flood damage, causing production to be suspended until the following year.

In June 1999, Moravan announced the sale of 100 Z 242s to Egypt, equivalent to a two-year backlog of work at then-current production rates. This order then represented approximately half of Moravan's backlog value of USD40 million, but was later cancelled. Moravan sold 22 aircraft in 2000, compared with only 15 in 1999. Aerolease, a joint venture with Dutch financial support, was formed in 2000 to lease Zlin aircraft to European flying clubs and flying training schools. The Z 142 C, out of production since 1995, was resumed as the result of a 2001 order; these were to be manufactured by LZ. Licensed manufacture of the Russian Technoavia Finist, with an Orenda OE-600 piston diesel engine, was planned under the designation Z 400 Rhino. Under a contract with EADS Socata, signed on 22 June 2001,

Moravan Aeroplanes was to produce complete fuselages for the TB series; deliveries were to begin in August 2002, at a rate of six to eight per month.

It was announced on 16 July 2001 that approval had been given for Moravan Aeroplanes to acquire Let Kunovice, with the exception of the L 610 G programme, for the sum of CZK200 million (USD5 million). Moravan intended to keep open the L 410/420 production line, as well as Let's L-13, L-23 and L-33 sailplanes, and planned to use the factory (renamed Letecké Zavody: LZ) also for its work on the Z 400 Rhino programme, but latter did not materialise. L 610 G programme subsequently acquired by LZ in early 2002.

Shortly after its acquisition of Let, Moravan Aeroplanes announced plans to establish a final assembly centre for its aircraft at Beeville, Texas, USA, in a joint venture with Pereira Internacional Aérea of Houston. However, company was declared bankrupt on 18 June 2004, following the earlier bankruptcy of LZ on 30 March that year, and a receiver was called in to restructure and reduce the business in size. Trading resumed, and in 2005 EASA Type Certificates were awarded to the Z 242 L and Z 143 L, as well as a fuel-injection version of the latter designated Z 143 LSi, with 175 kW (235 hp) Lycoming engine. The company opened its own flying school in May 2005. In October 2006, the assets administrators announced a common tender for the sale of part of Moravan Aeroplanes as "movables, incorporeal rights and other material values designated for the operation [of the company]", with manufacturing buildings to be sold in a separate auction. Meanwhile, technical support, sale of spare parts and sale of new aircraft were authorised to continue unrestricted.

ZLIN Z 242 L

TYPE: Primary prop trainer/sportplane.

PROGRAMME: Lycoming-powered version of earlier Z 142. Design started December 1988; first flight (OK-076) 14 February 1990; second prototype (SE-KMS) followed, both converted on production line from Z 142; Czech certification to FAR Pt 23 (A, U and N categories) 22 March 1992; also now certified in Argentina, Australia, Austria, Belgium, Canada, Denmark, Hungary, Israel, Luxembourg, Macedonia, Poland, Slovenia, Sweden, UK and USA. EASA type certificate A.027 awarded 1 February 2005.

CURRENT VERSIONS: **Z 242 L**: Aerobatics-capable trainer.

Description applies to this version.

Z 242 LA: Lower-powered, non-aerobatic version for primary, day/night and IFR training and glider/banner towing; g limits +4.4/-1.76. Prototype (OK-ANA) test-flown in 1996. No known production.

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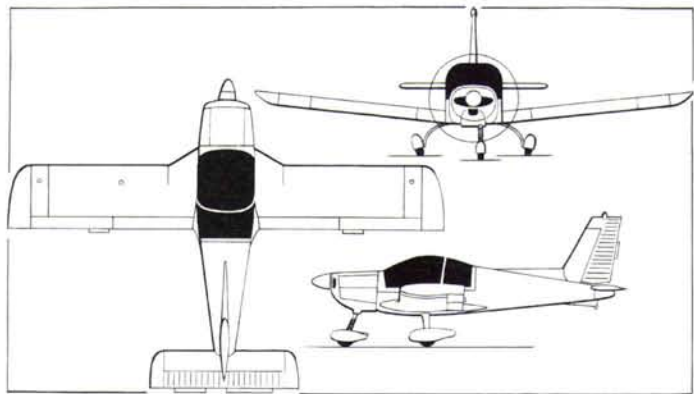
Zlin Z 242 L two-seat sportplane and trainer before delivery to Yemen Air Force

1128932



Indira Gandhi Rashtriya Uran Akademi (IGRUA) Zlin Z 242 primary trainer

1158601



Zlin Z 242 L primary prop trainer (James Goulding)

1158551

CUSTOMERS: Total of at least 133 delivered by mid-2006, for customers including Algeria (Air Force), Angola (Air Force), Argentina (one), Australia (one), Canada (15), Cuba (Border Guard), Czech Republic (Air Force, four), Egypt (Army), Germany, Hungary (Air Force), India, Israel (three), Macedonia (Air Force, four), Mexico (Navy, 10), Peru (Air Force, 18), Poland, Slovakia, Slovenia (Defence Force, seven), Sweden (two), UK (three), USA (38) and Yemen (Air Force, 12). Bid (unsuccessfully) for USAF T-3A Firefly replacement contract in 2001. Five to Yemen and one to Macedonian CAA in 2003; additional (unspecified) contracts in that year from unnamed Asian countries. Third Macedonian CAA aircraft delivered October 2004. Six ordered for Indian government flying school April 2005; first two handed over July, second and third pairs in January and March 2006. Four ordered by unidentified Asian customer in May 2006.

COSTS: Mexican Navy contract reported as approximately USD2.6 million (2002).

DESIGN FEATURES: Conventional low-wing monoplane. Constant-chord horizontal surfaces with wingroot glove. Sweptback fin with fillet. Changes from Z 142, apart from new engine, include redesigned (and shorter) engine cowlings and front fuselage, wing incidence, 0° sweep, wingroot glove, redesigned wing- and tailplane tips, redesigned fuel system and updated instruments. Spin recovery strake each side of cowlings.

Wing section NACA 63-416.5.

FLYING CONTROLS: Conventional and manual. Slotted, mass-balanced surfaces used for ailerons and flaps; horn-balanced elevator with trim tab; ground-adjustable tabs in ailerons and rudder; ailerons and elevator operated by rods, rudder by cables.

STRUCTURE: Mainly metal; wing has main and auxiliary spars; duralumin skins, fluted on control surfaces; metal engine cowlings; centre-fuselage is steel tube cage with composites skin panels.

LANDING GEAR: Non-retractable tricycle type, with nosewheel offset 13 cm (5.1 in) to port. Oleo-pneumatic nosewheel shock-absorber. Mainwheels carried on flat spring steel legs. Nosewheel steered (±38°) by rudder pedals. Mainwheels and Barum tyres size 420x150 or

Goodyear 6.00-6.5, pressure 1.90 bar (28 lb/sq in); nosewheel and Barum tyre size 350x135 or Goodyear 5.00-5, pressure 2.50 bar (36 lb/sq in). Hydraulic disc brakes on mainwheels can be operated from either seat. Parking brake standard.

POWER PLANT: One Textron Lycoming AEIO-360-A1B6 flat-four engine (149 kW; 200 hp at 2,700 rpm) driving an MTV-9-B-C/C-188-18a three-blade constant-speed wood/composites propeller or Hartzell HC-C3YR-4BF/EC 6890 three-blade constant-speed metal propeller. Fuel capacity 120 litres (31.7 US gallons; 26.4 Imp gallons). Normal category version wingtip tanks 55 litres (14.5 US gallons; 12.1 Imp gallons) each, bringing usable capacity to 230 litres (60.7 US gallons; 50.6 Imp gallons). Inverted flight limited to 1 minute. Oil capacity 8 litres (2.1 US gallons; 1.8 Imp gallons).

ACCOMMODATION: Side-by-side seats for two persons, instructor's seat to port. Both seats adjustable and permit use of back-type parachutes. Baggage space (20 kg; 44 lb) aft of seats. Cabin and windscreen heating and ventilation standard. Forward-sliding cockpit canopy. Dual controls standard.

SYSTEMS: Electrical system includes 1.6 kW 28 V engine-driven generator and 24 V 19 Ah Gill battery. External power source can be used for engine starting.

AVIONICS: To customer's specification, usually from Bendix/King Silver Crown or Garmin range.

EQUIPMENT: Standard equipment includes EGT gauge, fuel flow indicator, g meter and anti-collision beacon. Optional items include cockpit/instrument/cabin lights, landing/taxying lights, anti-collision lights, and towing gear for gliders of up to 500 kg (1,102 lb) weight.

DIMENSIONS, EXTERNAL:

Wing span	9.34 m (30 ft 7¾ in)
Wing chord, constant portion	1.50 m (4 ft 11 in)
Wing aspect ratio	6.3
Length overall	6.94 m (22 ft 9¼ in)
Height overall	2.95 m (9 ft 8¼ in)
Elevator span	3.20 m (10 ft 6 in)
Wheel track	2.33 m (7 ft 7¾ in)
Wheelbase	1.76 m (5 ft 9¼ in)
Propeller diameter: MTV	1.88 m (6 ft 2 in)
Hartzell	1.78 m (5 ft 10 in)
Propeller ground clearance: MTV	0.33 m (1 ft 1 in)
Hartzell	0.38 m (1 ft 3 in)

DIMENSIONS, INTERNAL:

Cabin: Length	1.80 m (5 ft 10¾ in)
Max width	1.12 m (3 ft 8 in)
Max height	1.20 m (3 ft 11¼ in)
Baggage space	0.20 m³ (7.1 cu ft)

AREAS:

Wings, gross	13.86 m² (149.2 sq ft)
Ailerons (total)	1.41 m² (15.18 sq ft)
Trailing-edge flaps (total)	1.41 m² (15.18 sq ft)
Fin	0.54 m² (5.81 sq ft)
Rudder, incl tab	0.81 m² (8.72 sq ft)
Tailplane	1.23 m² (13.24 sq ft)
Elevator, incl tabs	1.36 m² (14.64 sq ft)

WEIGHTS AND LOADINGS (A: Aerobatic, U: Utility, N: Normal category):

Basic weight empty: A, U, N	730 kg (1,609 lb)
Max T-O weight: A	970 kg (2,138 lb)
U	1,020 kg (2,248 lb)
N	1,090 kg (2,403 lb)
Max landing weight: A	970 kg (2,138 lb)
U	1,020 kg (2,248 lb)
N	1,050 kg (2,315 lb)
Max wing loading: A	70.3 kg/m² (14.40 lb/sq ft)
U	73.6 kg/m² (15.07 lb/sq ft)
N	78.6 kg/m² (16.11 lb/sq ft)
Max power loading: A	6.50 kg/kW (10.68 lb/hp)
U	6.84 kg/kW (11.24 lb/hp)
N	7.31 kg/kW (12.01 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE):	
all versions	170 kt (315 km/h; 195 mph)
Max level speed at S/L:	
A	127 kt (236 km/h; 146 mph)
U	125 kt (233 km/h; 144 mph)
N	124 kt (231 km/h; 143 mph)

Cruising speed at FL656 at 75% power:	
A	123 kt (227 km/h; 141 mph)
U	125 kt (233 km/h; 144 mph)
N	124 kt (231 km/h; 143 mph)
Max cruising speed at FL656 at 75% power:	
A	123 kt (227 km/h; 141 mph)
U	121 kt (225 km/h; 140 mph)
N	120 kt (223 km/h; 139 mph)
Stalling speed at S/L:	
flaps up: A	60 kt (111 km/h; 69 mph)
U	62 kt (114 km/h; 71 mph)
N	64 kt (118 km/h; 74 mph)
T-O flap setting: A	57 kt (105 km/h; 66 mph)
U	58 kt (107 km/h; 67 mph)
N	60 kt (111 km/h; 69 mph)
flaps down: A	51 kt (94 km/h; 59 mph)
U	53 kt (97 km/h; 61 mph)
N	54 kt (100 km/h; 63 mph)
Max rate of climb at S/L: A	
U	336 m (1,102 ft)/min
N	300 m (984 ft)/min
Service ceiling: A	
N	270 m (886 ft)/min
Service ceiling: A	
N	4,800 m (15,740 ft)
T-O run: A	
U	242 m (795 ft)
N	233 m (765 ft)
T-O to 15 m (50 ft): A	
U	306 m (1,005 ft)
N	560 m (1,840 ft)
Landing from 15 m (50 ft): A	
U	495 m (1,625 ft)
N	525 m (1,725 ft)
Landing run: A	
N	706 m (2,320 ft)
Landing from 15 m (50 ft): A	
U	516 m (1,695 ft)
N	560 m (1,840 ft)
Landing run: A	
N	265 m (870 ft)
Range with max fuel:	
A, U	267 n miles (495 km; 308 miles)
N	570 n miles (1,056 km; 656 miles)
Range at FL100, 65% power:	
A	228 n miles (424 km; 263 miles)
N	504 n miles (935 km; 581 miles)
g limits: A	
U	+6/-3.5
N	+5/-3
U	+3.8/-1.5

ZLIN Z 143

Czech Air Force designation: Z 143 MAF

TYPE: Four-seat lightplane.

PROGRAMME: Launched May 1991, with prototype construction beginning mid-year and first flight (Z 143 L prototype OK-074) 24 April 1992. Czech certification of this version 10 June 1994; now also certified in Austria, Bulgaria, Germany, Slovak Republic, Switzerland and USA. EASA type certificate A.028 awarded 1 February 2005.

CURRENT VERSIONS: Z 143 L: Standard version, with Textron Lycoming engine.

Detailed description applies to Z 143 L except where indicated.

Z 143 LSi: Version with Lycoming fuel-injection engine, enabling more advanced manoeuvres and unlimited spins. Prototype (OK-LSi); certified by Czech CAA May 2004. First production aircraft (OK-STA, c/n 55) delivered to Czech customer, Aeroklub Ostrava, August 2005.

CUSTOMERS: Total of 55 (including prototype and three testbeds/demonstrators) delivered by December 2005 to customers in Argentina (one), Austria (one), Bulgaria (two), Czech Republic (Air Force, four), Egypt (five), Germany (eight), Israel (two), Macedonia (one), Slovenia (two), Switzerland (four), Thailand (two), USA (seven) and elsewhere. Orders in May 2006 of three Z 143 L for Jharkhand Civil Aviation Department, India, and one LSi for an unidentified Asian customer.

COSTS: Standard (VFR) aircraft EUR195,000; limited edition IFR-equipped Z 143 L also EUR195,000; Z 143 LSi: EUR198,900 (VFR) and EUR220,500 (IFR) (all 2005).

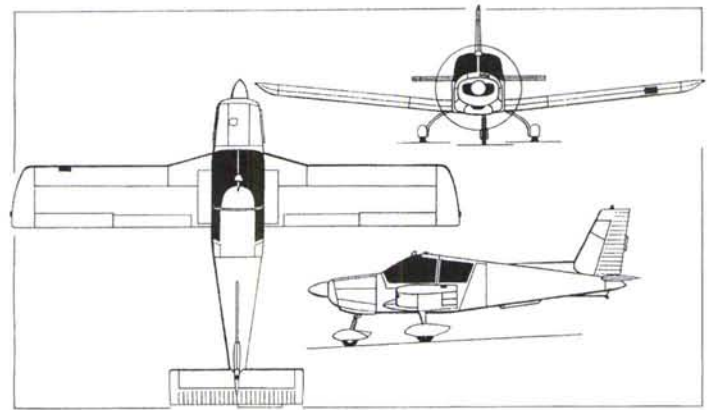
DESIGN FEATURES: Generally as for Z 242. For basic aerobatics (except inverted flight), glider towing and (with equipment) night and IFR training. Non-swept wings, of similar planform to Z 242 L but with NACA 63.416.5 wing section and 6° dihedral. Z 143 LSi: improvements include canopy jettison system and nitrogen-pressurised main spar.

FLYING CONTROLS: As for Z 242 L.

STRUCTURE: As for Z 242 L, nitrogen-pressurised wing main spar.

LANDING GEAR: As for Z 242 L.

POWER PLANT: Z 143 L: One Textron Lycoming O-540-J3A5 flat-six engine (175 kW; 235 hp at 2,400 rpm); MTV-9-B/195-45a three-blade variable-pitch propeller. Fuel capacity 122 litres (32.2 US gallons; 26.8 Imp gallons) in two wing tanks; provision for two 51 litre



General arrangement of the Zlin Z 143 L (Textron Lycoming O-540-J3A5 engine) (Mike Keep)

1158100

(13.5 US gallon; 11.2 Imp gallon) auxiliary tanks in Normal category version, raising total to 224 litres (59.2 US gallons; 49.3 Imp gallons). Oil capacity 12 litres (3.2 US gallons; 2.6 Imp gallons).

Z 143 LSi: One 175 kW (235 hp) Textron Lycoming IO-540-C4D5 flat-six with Bendix RSA-type fuel injection; propellers and fuel capacities as for Z 143 L. Oil capacity 11.4 litres (3.0 US gallons; 2.5 Imp gallons).

ACCOMMODATION: Four seats in 2 + 2 configuration, with pilot in front left-hand seat. All seats have four-point safety belts. Baggage compartment (capacity 60 kg; 132 lb) aft of rear seats, with external door on port side. One-piece forward-sliding canopy (jettisonable in L 143 LSi). Dual controls standard. Cabin and windscreen heating and ventilation standard.

SYSTEMS: As for Z 242 L.

AVIONICS: As for Z 242 L.

DIMENSIONS, EXTERNAL:

Wing span	10.14 m (33 ft 3¼ in)
Wing chord, mean aerodynamic	1.49 m (4 ft 10¾ in)
Wing aspect ratio	7.0
Length overall	7.58 m (24 ft 10½ in)
Height overall	2.91 m (9 ft 6½ in)
Elevator span	3.01 m (9 ft 10½ in)
Wheel track	2.44 m (8 ft 0 in)
Wheelbase	1.75 m (5 ft 9 in)
Propeller diameter	1.95 m (6 ft 4¾ in)
Propeller ground clearance	0.28 m (11 in)

DIMENSIONS, INTERNAL:

Baggage compartment volume	0.25 m ³ (8.83 cu ft)
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AREAS: As for Z 242 L except:

Wings, gross	14.78 m ² (159.1 sq ft)
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WEIGHTS AND LOADINGS (A: Aerobatic, N: Normal category):

Weight empty, equipped: A, N (L)	850 kg (1,874 lb)
N (LSi)	855 kg (1,885 lb)
Max T-O weight: A	1,080 kg (2,381 lb)
N	1,350 kg (2,976 lb)
Max landing weight: A	1,080 kg (2,381 lb)
N	1,280 kg (2,822 lb)
Max wing loading: A	73.1 kg/m ² (14.97 lb/sq ft)
N	91.4 kg/m ² (18.72 lb/sq ft)
Max power loading: A	6.16 kg/kW (10.13 lb/hp)
N	7.70 kg/kW (12.66 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE):

A, N	170 kt (315 km/h; 195 mph)
Max level speed at S/L: A	144 kt (267 km/h; 166 mph)
N (L)	142 kt (264 km/h; 164 mph)
N (LSi)	140 kt (260 km/h; 161 mph)

Max cruising speed at FL656 at 75% power:

A	127 kt (235 km/h; 146 mph)
N	125 kt (232 km/h; 144 mph)

Econ cruising speed at 60% power:

A	116 kt (216 km/h; 134 mph)
N (L)	111 kt (205 km/h; 127 mph)
N (LSi)	113 kt (209 km/h; 130 mph)

Stalling speed:

flaps up: A	58 kt (108 km/h; 67 mph)
N	63 kt (117 km/h; 73 mph)
flaps down: A (L), N (LSi)	54 kt (100 km/h; 63 mph)
N (L)	60 kt (110 km/h; 69 mph)

Max rate of climb at S/L: A

U	444 m (1,457 ft)/min
N	294 m (964 ft)/min

Service ceiling: A

U	5,700 m (18,700 ft)
N	4,170 m (13,680 ft)

T-O run: A, N (LSi)

N (L)	295 m (970 ft)
T-O to 15 m (50 ft): A	170 m (560 ft)
N	450 m (1,480 ft)
N	640 m (2,100 ft)

Landing from 15 m (50 ft): A

N	590 m (1,935 ft)
Landing run: A	765 m (2,510 ft)
N	305 m (1,000 ft)
N	380 m (1,250 ft)

Range at FL100:

at 65% power: A (L)	631 n miles (1,170 km; 727 miles)
N (L)	259 n miles (480 km; 298 miles)
at 60% power: N (LSi)	599 n miles (1,110 km; 689 miles)

g limits: A

N	+4.4/-1.76
N	+3.8/-1.52



Zlin Z 143 LSi prototype

1128934

ZLIN AVIATION

ZLIN AVIATION S.R.O.

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Tel/Fax: (+39 420) 577 94 12 50
e-mail: info@aerosavage.com and savage.ulm@tiscalinet.it
Web (1): www.zlinaero.com
Web (2): www.aerosavage.com
PRESIDENT: Paquale Russo

Morava Zlin Aero Service set up in 1999 to market the Russo Savage ultralight; renamed Zlin Aviation. Works are at Holešov Airport. US promotion began in 2005.

ZLIN AVIATION (RUSSO) SAVAGE

US marketing name: Savage Cub

TYPE: Tandem-seat ultralight/kitbuilt.

PROGRAMME: First flown 1997; public debut at CAP meeting, Capri, Italy, 1999. Initial development of Russo Savage was undertaken in Italy, with parts being manufactured in Czech Republic; entire operation now undertaken in Czech Republic; Czech type approval being sought in late 2003. Available in both ready to fly and kit form.

CURRENT VERSIONS: **Savage:** As described. Retrospectively designated Savage Classic.

Savage LSA: To US LSA rules as factory-built (Special LSA) or kit (Experimental LSA), latter with Rotax 912, 912S or 914 engine.

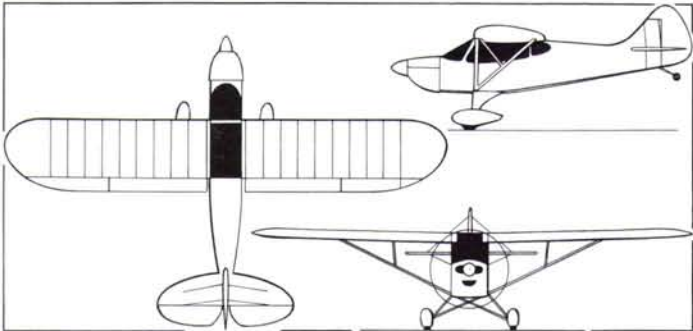
Savage Cruiser: Prototype completed mid-2005; modelled on Piper PA-12 Super Cruiser. As Savage, except 106 kt (197 km/h; 122 mph) max level speed; 97 kt (180 km/h; 119 mph) cruising speed; and 475 n mile (880 km; 546 mile) range.

Calao: Marketed in France by AIMS.

CUSTOMERS: Total of some 65 aircraft produced by mid-2005.

COSTS: Kit USD27,000, basic, or USD33,000, advanced, excluding engine; factory-built USD53,200 to 55,000 (Rotax 912 or 912S engine) from North American Sport Aviation (2005).

DESIGN FEATURES: Based on Piper J3 Cub; high, constant-chord wing with V lift struts and auxiliary struts each side; curved fin with dorsal strake; mutually wire-braced empennage; wings fold for storage and transportation. Quoted build time 350 hours. Wing section NACA 4412.



Russo/Zlin Aviation Savage Cruiser (James Goulding)

1151418

FLYING CONTROLS: Conventional and manual. Horn-balanced rudder, cable operated; simple-hinged elevator, pushrod operated. Cable-operated three-position simple flaps (maximum 35°). Manual trim in port elevator. Differential ailerons.

STRUCTURE: Fuselage of 4130 tubular welded steel; two-spar wings of 6061-T6 anodised aluminium; all fabric-covered. Composites engine cowl.

LANDING GEAR: Tailwheel type; fixed. Two faired-in side Vs hinged to lower longerons, plus half-axes, each with bungee cord shock-absorber, attached to compression frame. Mainwheels typically 8.00-6; tailwheel steerable, 2.50-4. Hydraulic brakes.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS driving a two-blade GT wooden propeller; other Rotax, Limbach and Subaru engines can be fitted. Fuel capacity 68 litres (18.0 US gallons; 15.0 Imp gallons) in two welded aluminium tanks in wingroots.

ACCOMMODATION: Single door on starboard side, Lexan 5006 windscreen and windows.

DIMENSIONS, EXTERNAL:

Wing span	9.31 m (30 ft 6½ in)
Length overall	6.39 m (20 ft 11½ in)
Height overall	2.03 m (6 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin max width	0.69 m (2 ft 3¼ in)
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AREAS:

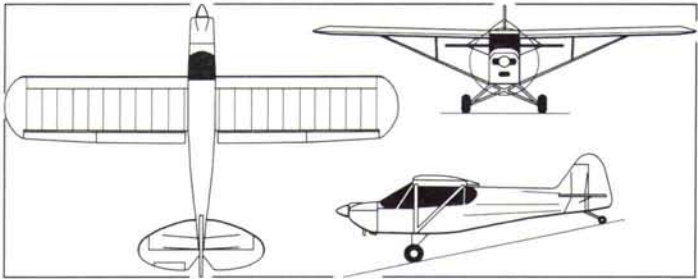
Wings, gross	14.20 m² (152.8 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	288 kg (635 lb)
Max T-O weight: Ultralight	450 kg (992 lb)
Experimental	540 kg (1,190 lb)

PERFORMANCE:

Never-exceed speed (VNE)	110 kt (205 km/h; 127 mph)
Max operating speed	104 kt (192 km/h; 119 mph)
Cruising speed at 75% power	92 kt (170 km/h; 106 mph)
Stalling speed, flaps down	32 kt (58 km/h; 36 mph)
Service ceiling	4,600 m (15,100 ft)
Max rate of climb at S/L	288 m (945 ft)/min
T-O run	85 m (280 ft)
Landing run	70 m (230 ft)
Range with max fuel	463 n miles (858 km; 533 miles)
g limits (ultimate)	+6/-3



Zlin Aviation (Russo) Savage tandem-seat ultralight (Paul Jackson)

1047725



Zlin Aviation Savage tandem-seat ultralight

1159194

Finland

PATRIA

PATRIA AVIATION OY (SUBSIDIARY OF PATRIA INDUSTRIES OY)

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e-mail: aviation@patria.fi
Web: www.patria.fi
EXECUTIVE VICE-PRESIDENT: Jukka Holkeri
VICE-PRESIDENT: Seppo Rytty

Patria Aviation (formerly Patria Finavitec) and its Valmet predecessors have built 30 types of aircraft, including 19 of Finnish design, since 1922. Five business units (fixed-wing aircraft, helicopters, avionics, aero-engines and pilot training); current activities include production of aircraft and aero-engine parts; and maintenance, overhaul, repair and modification of aircraft, aero-engines and their accessories. Workforce approximately 1,300, including engines facility at Linnavuori and Patria Helicopters AB (formerly Patria Ostermans Aero AB), a Swedish helicopter maintenance company acquired in 1999. Helsinki-based Pilot Aircraft Oy became

a wholly owned subsidiary of Patria Aviation on 24 March 2004, subsequently being renamed Patria Pilot Training Oy; activities include pilot and ATC training.

Patria Aviation currently manufactures rear and centre fuselage sections for the Embraer ERJ-135/145 under subcontract to Sonaca of Belgium, to which first shipsets were delivered in second half of 1998. MoUs signed in December 1999 by Patria Finavitec and Airbus Industrie for former to take part in conceptual definition of A380 and to explore other possible industrial co-operation, leading to manufacture of composites structures for A320 and A340 families. Selected in 2005 to design and deliver structures also for A400M, and in March 2006 to begin deliveries in 2007 of main landing gear fairings for A320 family. Agreed in September 2000 to support Sikorsky bid of S-92 for Nordic Standard Helicopter Programme (NSHP) requirement but, following selection of EHI and NHI as joint winners, Patria contracted on 19 October 2001 to assemble a minimum of 50 NH90s and associated RTM322 engines at Jämsä and Linnavuori, respectively; maiden flight of first aircraft (KH-202), 13 July 2005; deliveries taking place between 2005 and 2011. Work at new Jämsä factory began in September 2003. Contract for 150 NH90 rear fuselages received 16 September 2004; deliveries to begin in late 2005.

In June 2001, EADS acquired a 26.8 per cent interest in parent company Patria Industries Oy.

France

ABS

ABS AEROLIGHT

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e-mail: info@absaerolight.com
Web: www.absaerolight.com
GENERAL MANAGER: Raphaël Celier
XENON PRODUCTION DIRECTOR: Artur Trendak

Formed in July 1993, ABS (Aviation Business System) first exhibited the Xenon autogyro at Paris in June 2005. The company also produces a range of paragliders and the Pixy powered parachute UAV. A two-seat helicopter, the Xerus, is under development.

ABS XENON

TYPE: Two-seat autogyro ultralight kitbuilt.
PROGRAMME: Two prototype (including 83-SS) flying by time of first public showing at Paris, June 2005.
CUSTOMERS: Total of 10 sold by mid-2006.
COSTS: Hirth F30 powered, kit EUR34,000; with Rotax 912S EUR40,800; with Rotax 914 EUR48,800; all plus tax (2006).
DESIGN FEATURES: Enclosed cockpit (two doors optional); twin booms and unswept fins with high tailplane in centre of propeller thrust line. Mechanical prerotator and brake.
Aircraft rotor; aerodynamic section 8H12.
STRUCTURE: Monocoque composites fuselage pod with aluminium rotor boom and twin tailbooms. Tailplane of two identical composita (port and starboard) halves, each with endplate, inboard elements forming centreline fence. Rotor of 6005T6 aluminium.
FLYING CONTROLS: Manual. Twin rudders, each actuated by Bowden cable.
POWER PLANT: Prototype has one 77.2 kW (104 hp) Hirth F30A flat four driving an Ivoprop Patriot three-blade, fixed-pitch carbon composites propeller via 2.64 reduction gear; later versions have 73.5 kW (98.6 hp) Rotax 912S and 84.6 kW (113.4 hp) Rotax 914 engines. Fuel in two tanks, combined capacity 60 litres (15.9 US gallons; 13.2 Imp gallons).
LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring aluminium cantilever mainwheel legs with hydraulic brakes and 110/95-6 tyres. Steerable, undamped nosewheel leg with 4.00-4 tyre.
DIMENSIONS, EXTERNAL:
Rotor diameter 8.40 m (27 ft 6¾ in)
Fuselage length 4.90 m (16 ft 1 in)
Max width: at pod 1.25 m (4 ft 1¼ in)
at tailplane 2.20 m (7 ft 2½ in)
Height overall 2.80 m (9 ft 2¼ in)



ABS Xenon enclosed autogyro (R W Simpson)

1159197

AREAS:

Rotor disc	55.38 m² (596.1 sq ft)
WEIGHTS AND LOADINGS (A: F30; B: Rotax 912S; C: Rotax 914):	
Weight empty: A	245 kg (540 lb)
B	265 kg (584 lb)
C	275 kg (606 lb)
Max T-O weight: all	450 kg (992 lb)
PERFORMANCE (A: F30; B: Rotax 912S; C: Rotax 914):	
Max level speed: A	86 kt (160 km/h; 99 mph)
B	97 kt (180 km/h; 112 mph)
C	105 kt (195 km/h; 121 mph)
Max rate of climb at S/L: A	240 m (787 ft)/min
C	457 m (1,500 ft)/min
T-O run	10-100 m (33-330 ft)
Landing run	5 m (17 ft)
Endurance	4 h

AEROJAMES

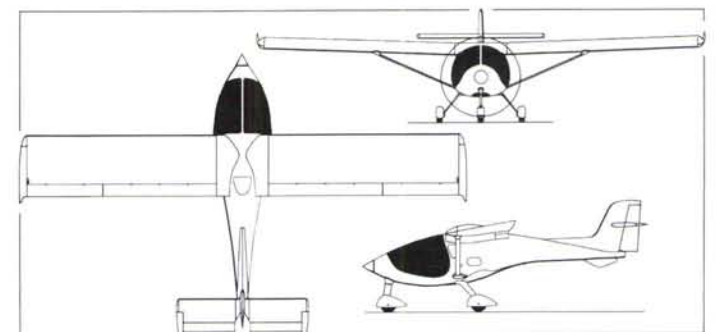
AEROJAMES SARL

2 rue Hyacinthe Campiglia, F-20090 Ajaccio
Tel/Fax: (+33 4) 92 62 20 74 or (+33 6) 84 48 99 27
Web: www.aerjames.com
DIRECTORS: Philippe Baffray
Paul Conil

AéroJames formed in 2004, having previously operated under the title of Isatis, the name of its first aircraft. Manufacture is in a 420 m² (4,525 sq ft) plant at Ajaccio and test-flying at Sisteron, south-east France.

AÉROJAMES ISATIS 01

TYPE: Side-by-side ultralight.
PROGRAMME: Design began 2001. Partly complete prototype first shown at Aero '03, Friedrichshafen, April 2003. By early 2005 static testing was complete, the prototype (F-WPDG) conducting its maiden flight on 24 February 2005. Assigned to EASA certification, although initial aircraft to be marketed as Ultralights. First production aircraft was due for completion in June 2006.
COSTS: EUR62,000, excluding tax, flyaway (2006).



Aerojames Isatis 01 general arrangement (Paul Jackson)

1159137

DESIGN FEATURES: Optimised for low noise and emissions; economy and ease of stowage. Mid-engined configuration with high, strut-braced, foldable wings, T tail with small underfin.

FLYING CONTROLS: Conventional and manual. Balanced ailerons. Slotted flaps, electrically deflected +6° for high-speed cruise; -15° for T-O; and -30° for landing.



Prototype AéroJames Isatis 01 in April 2005 (Paul Jackson)

1121788

STRUCTURE: Composites skin throughout; carbon fibre driveshaft (passing through cockpit from engine to propeller) and cantilever mainwheel legs. Carbon fibre wing structure with glass fibre skin.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, sweptback, steel tube mainwheel legs with composites fairings. Shock loads transmitted to horizontal torsion bars within fuselage, anchored on centreline. Steerable nosewheel damped by oleo and external helical spring. All tyres 4.00-6; speed fairings over each.

POWER PLANT: One mid-mounted BMW 1200 flat-four, rated at 73.5 kW (98.6 hp) with catalytic exhaust converter, driving a three-blade carbon fibre, ground-adjustable pitch propeller. Fuel capacity 64 litres (16.9 US gallons; 14.1 Imp gallons) in two wing tanks, of which 60 litres (15.8 US gallons; 13.2 Imp gallons) usable.

EQUIPMENT: Junkers Magnum ballistic parachute standard.

DIMENSIONS, EXTERNAL:

Wing span	9.80 m (32 ft 2 in)
Length overall	6.30 m (20 ft 8 in)
Height overall	2.50 m (8 ft 2½ in)

DIMENSIONS, INTERNAL:

Cockpit max width	1.30 m (4 ft 3¼ in)
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AREAS:

Wings, gross	11.40 m² (122.7 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	270 kg (595 lb)
Max T-O weight	472.5 kg (1,041 lb)

PERFORMANCE (estimated):

Never-exceed speed (VNE)	145 kt (270 km/h; 167 mph)
Normal cruising speed	124 kt (230 km/h; 143 mph)
Stalling speed, flaps down	30 kt (55 km/h; 35 mph)
T-O run	100 m (330 ft)
Landing from 15 m (50 ft)	188 m (617 ft)
Range	809 n miles (1,500 km; 932 miles)
g limits	+4.4/-2.2

AEROKUHLMANN

AEROKUHLMANN
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e-mail: aerokuhlmann@magic.fr
Web: www.chez.com/scub
DIRECTOR: Hervé Kuhlmann
COMMERCIAL DIRECTOR: Daniel Feldzer

BUSINESS ADDRESS:
Immeuble Aéroclub de France, 6 rue Galilée, F-75782 Paris Cedex 16
Tel/Fax: (+33 1) 40 70 13 76

AeroKuhlmann's first product, built in the company's 600 m² (6,450 sq ft) factory on La Ferté-Alais airfield, near Cerny, is the SCUB. No recent communication has been received from the company.

AERONIX

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Fax: (+33 2) 54 46 29 29
e-mail: contact@aeronix.fr
Web: www.aeronix.fr
DIRECTOR GENERAL: Lionel de Mauduit du Plessis
TECHNICAL DIRECTOR: Rémi Cuvelier
COMMERCIAL DIRECTOR: Gérard Mosali
TEST PILOT: Gary 'Cody' Purdom

Formed in 1999, Aeronix has launched production of its first aircraft, the Airelle. The aircraft was displayed statically at Paris in June 2005 and in flight at the RSA rally at Breuil in September 2005. The company also markets avionics and provides simulated training.



Fifth production Aeronix Airelle (Paul Jackson)

1151704

AERONIX AIRELLE

TYPE: Side-by-side ultralight/kitbuilt.

PROGRAMME: Development began in 1999; one-third scale model flew October 2000. Announced at Paris Air Show, June 2001; first flight February 2002 (unannounced); mockup shown at Air, June 2003. Deliveries of kit version began in 2003; concentration on Ultralight version; VLA to be available later.

Company test pilot Gary Purdom is planning a pole-to-pole flight to promote the Airelle.

CURRENT VERSIONS: **Ultralight:** (Ultra Léger) Two 29.8 kW (40 hp) Zanzottera flat-twin engines replaced by Hirth F23ESs of same power in production version; Duc or Arplast or Ecoprop, ground-adjustable pitch three-blade propellers. As described.

Two-seat lightplane: (Avion Biplace) Projected version for VLA certification; two engines up to 74.6 kW (100 hp).

Four-seat lightplane: (Avion Quadriplace) Projected stretched version with two engines up to 74.6 kW (100 hp). Available from 2006.

CUSTOMERS: Total 36 orders and five built by June 2005.

COSTS: Ultralight, flyaway EUR95,000; kit EUR45,000 including engine and avionics; both plus tax (2005).

DESIGN FEATURES: Unconventional 'four-wing, push-pull' design, featuring tapered, 3° anhedral foreplane with downturned tips and sweptback (30°), 2° dihedral mainplane with vertical fins at tips; fins have inturned tips. Flight control system lacking pilot's rudder pedals and incorporating 'glass cockpit'.

FLYING CONTROLS: Manual. Plain ailerons (with external mass balances and upper surface piano hinges) and flaps on mainplane, plus rudder in each fin; full-span elevators, each with trim tab, on foreplane. Piano-hinged split rudders operable conventionally in unison; split one side only as spoilers; or both split as airbrakes.

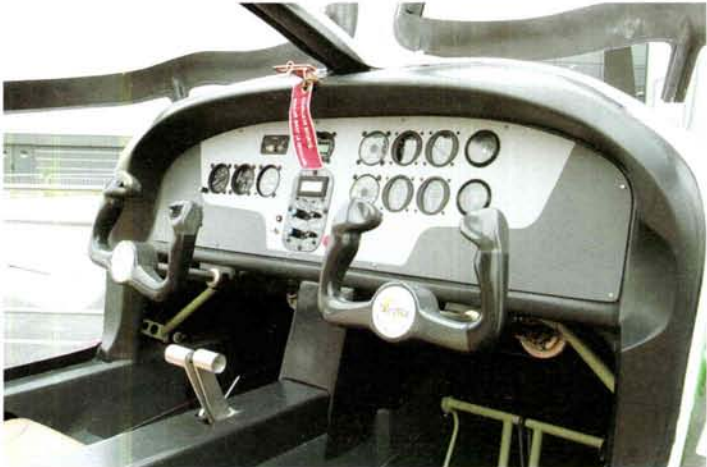
STRUCTURE: Generally of carbon fibre.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring composites cantilever mainwheel legs. Mainwheels 4.00-6 or 110/95-6; steerable nosewheel, 11x4.00-5.

POWER PLANT: Two piston engines, power according to variant, in tractor/pusher arrangement, each driving Arplast or Duc three-blade propeller via 2.5:1 reduction gear. Fuel in wing tanks, combined capacity 62 litres (16.4 US gallons; 13.6 Imp gallons) in ultralight; 160 litres (42.3 US gallons; 35.2 Imp gallons) in two- and four-seat versions.

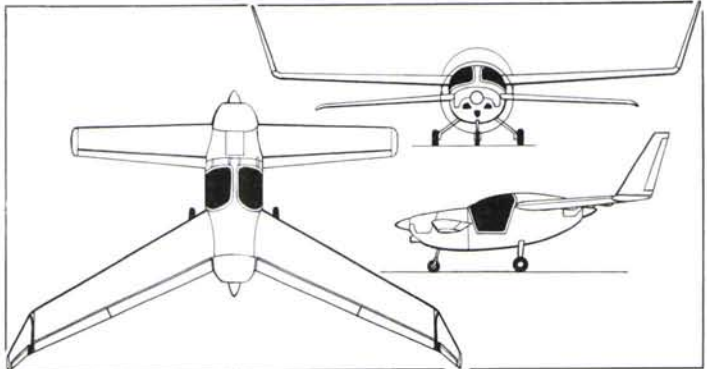
ACCOMMODATION: Two or four persons, according to variant. Two centreline-hinged, forward/upward-opening canopy/doors.

EQUIPMENT: Ballistic recovery parachute standard.



Non-standard instrument panel of proposed pole-to-pole Aeronix Airelle
(Paul Jackson) 1127691

AVIONICS: Comms: Bendix/King KY 97 VHF.	
Instrumentation: Single LCD.	
EQUIPMENT: BRS-5 ballistic parachute.	
DIMENSIONS, EXTERNAL:	
Wing span	9.46 m (31 ft 0½ in)
Length: overall	5.88 m (19 ft 3½ in)
fuselage	4.225 m (13 ft 10¾ in)
Height overall	3.015 m (9 ft 10¾ in)
Wheel track (outer rims)	1.875 m (6 ft 1¾ in)
Wheelbase	1.87 m (6 ft 1½ in)
Propeller diameter	1.60 m (5 ft 3 in)



General arrangement of Aeronix Airelle Ultralight (James Goulding) 1154283

DIMENSIONS, INTERNAL:	
Cabin max width	1.14 m (3 ft 9 in)
AREAS:	
Wings, gross	15.00 m ² (161.5 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped	295 kg (650 lb)
Max T-O weight	472.5 kg (1,041 lb)
PERFORMANCE:	
Never-exceed speed (VNE)	156 kt (290 km/h; 180 mph)
Max level speed	146 kt (270 km/h; 168 mph)
Cruising speed	127 kt (235 km/h; 146 mph)
Stalling speed	32 kt (58 km/h; 36 mph)
Max rate of climb at S/L	600 m (1,968 ft)/min
Rate of climb at S/L, OEI	180 m (591 ft)/min
Service ceiling	5,000 m (16,400 ft)
Range with max payload	378 n miles (700 km; 435 miles)

AERO SERVICES

AERO SERVICES GUEPARD

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DIRECTOR: Jean-Daniel Roman
HEAD OF ENGINEERING: Jean-Michel Razoux

Aéro Services Guépard produces the Guépard and Guépy ultralights; four versions are available.

AERO SERVICES GUÉPARD and GUEPY

TYPE: Side-by-side ultralight.
PROGRAMME: Certified by DGAC in ULM category, August 2000.
CURRENT VERSIONS: **Guépard**: Highest-powered version, *As described*. Flyaway or kit.
 Guépy: Powered by 48.0 kW (64.4 hp) Rotax 582 or 59.7 kW (80 hp) Jabiru 2200. Metal wing with fabric covering and full-span flaperons; choice of constant-chord or tapered wing. Weight empty 240 kg (529 lb) or 286 kg (630 lb) with optional extras. Flyaway or kit.
 Guépy Club: Lowest-powered version, with 34.0 kW (45.6 hp) Rotax 503 or 48.0 kW (64.4 hp) Rotax 582. Weight empty (fabric-covered wing only) 210 kg (463 lb) or 286 kg (630 lb) with optional extras.
 Super Guépard: Announced 2004 with reprofiled fuselage and choice of metal or fabric-covered tubular steel wing.
CUSTOMERS: More than 80 sold in France by 2003.
COSTS: Guépard, flyaway: fabric-covered wing: Rotax 912 EUR42,745, Rotax 912S EUR44,290; all-aluminium wing: Rotax 912 EUR48,410, Rotax 912S EUR50,367. Guépard kit (less engine) with fabric wing EUR20,600, with aluminium wing EUR26,780. Guépy, flyaway: constant-chord wing: Rotax 582 EUR32,030, Jabiru EUR37,750; tapered wing: Rotax 582 EUR33,475, Jabiru EUR39,140; kit (less engine), constant-chord wing EUR20,085, tapered wing EUR21,115, Guépy Club Kit EUR16,160. (All 2006.)
DESIGN FEATURES: Constant-chord, high wing with V-strut bracing. Tailplane at base of sweptback fin, braced below by V-strut.
FLYING CONTROLS: Conventional and manual. Flaps.



Aéro Services Super Guépard (R W Simpson) 1159266

STRUCTURE: Airframe of 4130 aluminium tube, with Dacron covering; wings 2017 and 2024 aluminium with Dacron or aluminium covering.	
LANDING GEAR: Fixed; option of nosewheel or tailwheel type. Brakes.	
POWER PLANT: One piston engine: 48.0 kW (64.4 hp) Rotax 582, 73.5 kW (98.6 hp) Rotax 912 or 84.5 kW (113.3 hp) Rotax 912S. Two-blade (optional three-blade) propeller. Standard fuel 65 litres (17.2 US gallons; 14.3 Imp gallons).	
DIMENSIONS, EXTERNAL:	
Wing span	9.60 m (31 ft 6 in)
AREAS:	
Wings, gross	14.60 m ² (157.2 sq ft)
WEIGHTS AND LOADINGS (Rotax 912S):	
Weight empty: basic	262 kg (578 lb)
with all options	286 kg (631 lb)
Max T-O weight	472.5 kg (1,041 lb)
PERFORMANCE (Rotax 912S):	
Max level speed	103 kt (190 km/h; 118 mph)
Normal cruising speed	97 kt (180 km/h; 112 mph)
Stalling speed, flaps down	30 kt (55 km/h; 35 mph)
Max rate of climb	360 m (1,181 ft)/min
T-O run	50 m (165 ft)
Landing run	70 m (230 ft)

Fax: (+33 2) 54 42 00 11

ALMS was formed in 2001 to build and market ultralight aircraft; the company's first design was the Calao, optimised for aerial work and based on the Zlin Savage, for which the company is the French agent; marketing began in 2005 and in June of that year ALMS launched its factory-built version of the Jodel D20; following its takeover of Sauper on 1 February 2006, it also markets the J300 and Papageno.

ALMS CALAO

TYPE: Multisensor surveillance lightplane.
PROGRAMME: Adaptation of Pasquale Russo's Zlin Savage for low-cost surveillance; also available for spraying and medical evaluation roles. Prototype (91-XZ, F-JPMO) exhibited at Aero '05, Friedrichshafen, April 2005 and demonstrator 91-XU at Paris Air Show, June 2005.
DESIGN FEATURES: Offered complete, with Rotax 912 engine. *Generally as for Zlin Savage except the following.*

ALMS

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Aérodrome de Blois-le Breuil, F-41330 Villefrancoeur
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ALMS Calao demonstrator (Paul Jackson)

ACCOMMODATION: Two, in tandem, including equipment operator in rear seat.
EQUIPMENT: Sony FCB-EX 780SP gyro-stabilised, 360° turret beneath centre fuselage mounting video camera with 56° to 8° zoom; datalink, infra-red camera. Medevac version has integral stretcher; spray version has Micronair 7000 system with 100 litre (26.4 US gallon; 22.0 Imp gallon) tank.

ALMS JODEL D 20

TYPE: Side-by-side ultralight/kitbuilt.
PROGRAMME: First Jodel light aircraft designed by Jean Delmontez and Edouard Joly in 1946: D 20 Jubilé designed by M Delmontez in 1996 and named to mark 50th anniversary.
Initially marketed as plans-built by Avions Jodel at Beaune, operable as lightplane or ultralight; early examples with JPX 4T 75/A engine; later Rotax 912 or Jabiru 2200. First aircraft (F-PSAB, c/n 01) built by Patrice Roux and flew 3 March 1997; first in Ultralight category was WAAA-01 (c/n 08), flown May 2000.
Production rights to ultralight acquired by Cedric Braquet of Aeroconsult; marketing began by ALMS in mid-2003, although prototype of this version (91-YC: F-JPGW) not flown until mid-2004; promotion began at end 2005.
CUSTOMERS: ALMS prototype built from 21st set of plans (c/n 22; No. 13 not assigned). Previous 20 aircraft included at least nine ultralights (of which three with tailwheel); not all completed, including sole D 21, begun by Aero Club de Bourgogne. Further three retractable gear versions identified as DelVion DVD-01 Diesel marketed by Jacques Vion.
COSTS: Completed, flyaway, EUR69,000 to EUR77,000, including tax, according to D20 version (2005). Kit prices on application.
DESIGN FEATURES: Classic Jodel configuration with dihedral on outer wing panels and all-moving tail surfaces. Low wing of constant chord inboard; tapered on dihedral panels; sweptback fin and constant-chord tailplane.
Optimised for sport flying and amateur construction. Wider fuselage version of Jodel D 19.

FLYING CONTROLS: Manual; cable actuation. All moving fin with horn balance; all-moving tailplane with anti-balance tab starboard side. Plain, three-position flaps. Plain ailerons with sealed upper gaps.
STRUCTURE: Generally of wood and plywood; some composites. Spruce frame fuselage covered with Okoume plywood above, with Dacron sides and belly, except composites engine cowlings and plywood cockpit sides. Five bulkheads and seven formers, reinforced by vertical spruce members. One-piece wing of plywood box construction, with cantilever ribs reinforced with plywood; Dacron covering, except plywood flaps and leading-edge. One-piece, single-spar tailplane with six ribs; fin of plywood box structure; both Dacron-covered.
LANDING GEAR: Fixed. Wing-mounted cantilever mainwheel legs with integral oleo-pneumatic shock-absorbers; tyre size 4.00-6. Option of castoring nosewheel with 4.00-4 tyre and oleo-pneumatic shock-absorber; or steerable tailwheel. Hydraulic disc brakes.
POWER PLANT: One flat-four piston engine. Option of 59.6 kW (79.9 hp) Rotax 912 UL; 73.5 kW (98.6 hp) Rotax 912S; or 59.7 kW (80 hp) Jabiru 2200 driving two- (Rotax 912 UL, Jabiru 2200) or three-blade (Rotax 912S) wood or carbon fibre propeller. Fuel tank ahead of cockpit, capacity 55 litres (14.5 US gallons; 12.1 Imp gallons).
DIMENSIONS, EXTERNAL:
Wing span 7.50 m (24 ft 7¼ in)
Length overall 6.05 m (19 ft 10¼ in)
Height overall 1.93 m (6 ft 4 in)
Wheelbase 1.89 m (6 ft 2½ in)
DIMENSIONS, INTERNAL:
Cockpit max width 1.12 m (3 ft 8 in)
AREAS:
Wings, gross 10.50 m² (113.0 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 260 kg (573 lb)
Max T-O weight 450 kg (992 lb)



Prototype ALMS-built Jodel D 20 (Paul Jackson)

PERFORMANCE:

Max level speed	124 kt (230 km/h; 143 mph)
Cruising speed	111 kt (205 km/h; 127 mph)
Stalling speed	33 kt (60 km/h; 38 mph)
T-O run	60 m (200 ft)
Landing run	50 m (165 ft)
Range	324 n miles (600 km; 372 miles)
g limits	+6/-3

ALMS J.300 SERIES 4 JOKER

TYPE: Side-by-side ultralight.
PROGRAMME: Designed by Tony Minguet in 1987. Series 3, introduced in 2000, has modified empennage, and new instrument panel. Series 4, introduced in 2006, includes a tricycle option.
CURRENT VERSIONS: **Civilian version** is used for private flying, crop-spraying, aerial photography and in-flight survey work. **Military version** features larger tyres and a full instrument panel including artificial horizon, UHF radio, GPS and transponder.
CUSTOMERS: Total 102 of all versions built by 2004, including at least 18 in Africa; most recent sales to Senegal, Madagascar, Cameroon and the Arabian Peninsula. Two evaluated by the French Army in 1996.
COSTS: EUR39,000 (2004) excluding tax.
DESIGN FEATURES: Braced, high-wing monoplane with mid-mounted, braced tailplane; constant chord wing with tapered tips.
Wing section Clark Y; 2° 12' anhedral.
FLYING CONTROLS: Conventional and manual. Self-centring (by helical spring) elevator. Flight-adjustable tab in each elevator. No flaps.
STRUCTURE: Welded steel (25CD4S) tube airframe; Diatex 1500EV3 fabric covering; composites engine cowlings.
LANDING GEAR: Tailwheel type; fixed. Two side Vs hinged to lower longerons, plus half-axes sprung under centreline with bungee cord. Mainwheels 6.00-6; speed fairings optional; hydraulic Grimeca brakes; tailwheel 2.60x85. Nosewheel version introduced 2006.
POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 or (optional) 73.5 kW (98.6 hp) Rotax 912 ULS flat-four driving a DUC Hélices three-blade propeller. Two fuel tanks beneath seats, each 48 litres (12.7 US gallons; 10.6 Imp gallons) capacity of which 47 litres (12.4 US gallons; 10.3 Imp gallons) are usable. Oil capacity 3.0 litres (0.8 US gallon; 0.7 Imp gallon).
SYSTEMS: 12 V 17 Ah battery.
AVIONICS: Comms: VHF radio.
Flight: Garmin III Pilot standard; GPS 295 optional.

EQUIPMENT: Optional ballistic parachute.
DIMENSIONS, EXTERNAL:
Wing span 9.04 m (29 ft 8 in)
Length overall 5.95 m (19 ft 6¼ in)
Height overall 2.00 m (6 ft 6¾ in)
AREAS:
Wings, gross 15.60 m² (167.9 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 282 kg (622 lb)
Max T-O weight 450 kg (992 lb)
with optional parachute 472.5 kg (1,042 lb)
PERFORMANCE (Rotax 912 ULS):
Max operating speed (VMO) 106 kt (198 km/h; 123 mph)
Max cruising speed 97 kt (180 km/h; 112 mph)
Econ cruising speed 76 kt (140 km/h; 87 mph)
Stalling speed 32 kt (58 km/h; 36 mph)
Max rate of climb at S/L 300 m (984 ft)/min
T-O run 80 m (262 ft)
Landing run 100 m (330 ft)
Range 432 n miles (800 km; 497 miles)
Endurance 6 h



First production tricycle J.300 Joker Series 4 and ALMS J.300 Jokers overflying the Chateau de Chenonceau

ALMS PAPANGO

English name: Black Kite
TYPE: Side-by-side ultralight; two-seat lightplane.
PROGRAMME: First flown (F-WWNO) as VLA, 30 November 2002; second prototype (41-ME/F-PJHE) built as ultralight. Marketing began end of 2004, when first deliveries of Ultralight due in July 2005. VLA certification scheduled for mid-2006.
CURRENT VERSIONS: **VLA:** Lightplane. Features include certified Rotax 912 S engine, Evra propeller, electric elevator trim, Cleveland hydraulic brakes and tyres, and standard fit of artificial horizon, GPS, transponder and navigation lights.



Second prototype ALMS Papango in Ultralight configuration (Paul Jackson) 1129182

ULM: Ultralight, Rotax 912 ULS engine, Duc propeller, 8.00x6 tyres with Grimeca hydraulic brakes and electric elevator trim. Empty weight 272 kg (600 lb). POC prototype (41-ME/F-PJHE) flown third quarter of 2004.

Kit: Experimental category; engines up to 89.5 kW (120 hp) and 650 kg (1,433 lb) MTOW.

COSTS: VLA EUR90,000, including tax, complete. ULM EUR60,000, including tax, complete. Kit approximately EUR30,000, excluding engine (2005).

DESIGN FEATURES: Rugged lightplane with extensive glazing. Braced, high-wing monoplane; mid-mounted tailplane and sharply tapered fin; long mainwheel legs.

Wing section NACA 23015; tailplane section NACA 0010.

FLYING CONTROLS: Conventional and manual. All-moving tailplane with electrically actuated, full-span anti-balance tab. (Initially flown with full-span flaperons which replaced by flaps). Actuation by pushrods (elevator) and cables.

STRUCTURE: Fuselage structure of welded 4130 steel tube in cockpit area, and aluminium 5086. Wings aluminium 5086 with Diatex 1500EV3 fabric covering. Polyester engine cowlings.

LANDING GEAR: Tailwheel type; fixed. Two streamlined side Vs hinged to cockpit frame and attached to oleo shock-absorbers anchored to cockpit sides. Cleveland 6.00-6 mainwheels (8.00-6 optional) and Cleveland hydraulic disc brakes. Solid tailwheel; steerable.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912S or 912 ULS flat-four driving an Evra two-blade, fixed pitch, wooden or Duc propeller. Fuel tank behind seats; capacity 70 litres (18.5 US gallons; 15.4 Imp gallons).

SYSTEMS: 17 Ah battery and 20 A generator.

AVIONICS: Comms: VHF radio and transmitter.

Flight: Garmin 295 GPS.

EQUIPMENT: BRS 1050 ballistic parachute optional.

DIMENSIONS, EXTERNAL:

Wing span	9.40 m (30 ft 10 in)
Wing chord, constant	1.63 m (5 ft 4 in)
Length overall	6.50 m (21 ft 4 in)
Height overall	2.50 m (8 ft 2½ in)
Tailplane span	2.40 m (7 ft 10½ in)
Tailplane chord, constant	0.80 m (2 ft 7½ in)
Wheel track	2.40 m (7 ft 10½ in)

DIMENSIONS, INTERNAL:

Cabin max width	1.23 m (4 ft 0½ in)
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AREAS:

Wings, gross	15.35 m² (165.2 sq ft)
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WEIGHTS AND LOADINGS:

Max T-O weight: VLA, kit	650 kg (1,433 lb)
ULM	472.5 kg (1,042 lb)

PERFORMANCE (VLA: provisional/demonstrated):

Never-exceed speed (VNE)	124 kt (230 km/h; 142 mph)
Max level speed	97 kt (180 km/h; 112 mph)
Econ cruising speed	81 kt (150 km/h; 93 mph)
Stalling speed, clean	37 kt (67 km/h; 42 mph)
flaps down	32 kt (58 km/h; 36 mph)
Max rate of climb	300 m (984 ft)/min
T-O run	70 m (230 ft)
Landing run	60 m (200 ft)

AMEUR

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Web: www.sm2a.fr

PRESIDENT AND CHIEF DESIGNER: Boussad Ameur

Ameur Aviation (known until 2001 as Ameur Aviation Technologie - AAT) originated on the island of Corsica, but moved to mainland France and was part of the Slicom Group.

The company was declared bankrupt on 3 February 2006 and a liquidator appointed.

APEX

APEX INTERNATIONAL

1 rue de Troyes, F-21121 Darois

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Web: www.apex-aircraft.com

CHAIRMAN AND CEO: Guy Pellissier

SALES MANAGER: Pierre Pelletier

Three French light aircraft manufacturers are included in the holding company Apex International (formerly known as Aéronautique Service); products of BUL, CAP and Robin are described where appropriate; related companies are detailed here. In total, the group had 200 employees in 2001, which declined to 160 in 2005.

In late 2001, the company announced that it was embarking on restructuring its component parts and building a new customer service centre at Darois, due to be operational in April 2002.

However, Apex entered voluntary receivership in September 2002 and underwent financial restructuring while aircraft production at its member companies was slowed or stopped: on

30 May 2003 a French court approved an extension of receivership until July, by which time Apex hoped to have completed restructuring, including downsizing of its workforce and focusing on FAA certification for CAP and Robin aircraft; work on the CAP 222 was discontinued; receivership lifted on 25 August 2003. In the year following imposition of receivership Apex delivered 23 aircraft of various types; in 2006 production was set at 50 to 70 per year.

In October 2004, production of the Robin Alpha range was transferred to New Zealand following the sale of manufacturing rights to Alpha Aviation.

Constructions Aéronautiques de Bourgogne (CAB): Construction of BUL Zülü and CAP 10 at Darois, and Robin aircraft at Bernay. Zülü prototype was not followed by any production aircraft. President: Patrice Serignac.

CAP Aviation: Construction of CAP 232 and after-sales service of all CAP aircraft (including former Mudry CAP designs) at Bernay. Director-General: Eric Willaert.

Aviation Service Center (ASCO): after-sales service and support, Director-General: Ludovic Paul.

Group administrative services are provided by Aeronautique Financements & Services.

AVIAKIT

AVIAKIT FLIGHT CONCEPT SARL

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Web: www.aviakit.com

Original AviaKit company formed by Roland Prevot to produce kits of his Hermes. Production rights were acquired by PJB Aerocomposite of St Leger sous Brienne on 1 September 2001, but financial aspects of the transfer were not completed and the proposed Véga 2000 programme lapsed.

Dormant AviaKit was revived under new management and took over new premises at Troyes on 15 June 2004, relaunching the aircraft as Vega 3000.

Future AviaKit projects will include the Parasol in the 1930s style; and 100 hp (74.6 kW) Résolution two-seat, retractable gear, high speed tourer; work on both was continuing during 2006.



AviaKit Vega 3000 nosewheel version (Paul Jackson) 1159339

Vega 3000 CJ80, CR80 and CR100 with *Classique* (classic; tailwheel) gear and same engines.

COSTS: Kits, without engine, EUR24,500 (tailwheel or tricycle). Completed (tricycle only) aircraft: Jabiru 2200 EUR43,600, Rotax 912 UL EUR45,800, Rotax 912 ULS EUR47,950; all plus tax (2006).

DESIGN FEATURES: Low-wing tourer with high-mounted canopy and centre fuselage of sharply reduced cross-section aft of cockpit; low-mounted tailplane (replaces strut-braced, cruciform empennage of Hermes); small underfin. Other changes to design made by PJB include cutaway base of rudder and redesigned wing of shorter span.

NACA 23015 wing section with 5° dihedral. Quoted build time is 300 hours.

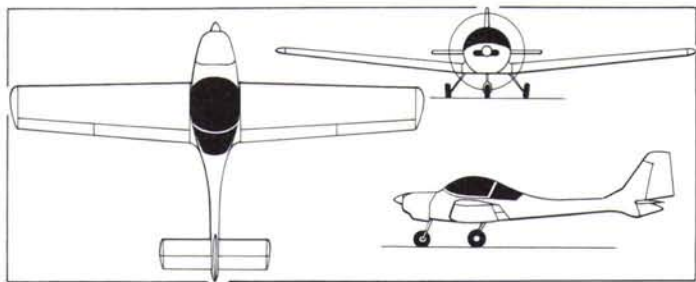
FLYING CONTROLS: Conventional and manual, with control sticks. Large ground-adjustable tab added to rudder by 1998. Electrically actuated flaps, maximum deflection 45°.

AVIAKIT VEGA 3000

TYPE: Side-by-side ultralight.

DEVELOPMENT: Originally marketed as a kitbuilt by AviaKit as Hermes and around 35 built before project was due to be taken over by PJB Aerocomposite on 1 September 2001. Despite being shown at the 2001 Paris Salon in new guise as Véga 2000, the planned transfer failed to take place. AviaKit re-established in 2004 to build Véga 3000s, second of which was exhibited at Aero '05, Friedrichshafen, April 2005.

CURRENT VERSIONS: Three options of engine and two options of landing gear. **Vega 3000 TJ80, TR80 and TR100** with tricycle gear and Jabiru, Rotax 912 UL and 912 ULS engines;



Aviakit Véga 3000 side-by-side ultralight (James Goulding)

1151424

STRUCTURE: Fuselage of glass fibre with optional carbon fibre cockpit. Wings are wood/composites with carbon spar; strut-supported mid-mounted tailplane.

LANDING GEAR: Choice of tricycle or tailwheel type; both fixed. Fuselage-mounted spring cantilever mainwheel legs with optional speed fairings. Hydraulic brakes.

POWER PLANT: Choice of 73.5 kW (98.6 hp) Rotax 912 ULS, 59.6 kW (79.9 hp) Rotax 912 UL or 59.7 kW (80 hp) Jabiru 2200 engines. Duc two-blade, fixed-pitch, carbon fibre propeller standard; Duc three-blade, Neuform two/three-blade and Filser and Neuform variable-pitch propellers optional. Fuel capacity 80 litres (21.1 US gallons; 17.6 Imp gallons) in two wing tanks.

AVIONICS:

To customer's requirements.

EQUIPMENT: Navigation lights, strobe light and Junkers high-speed ballistic parachute recovery system optional.

DIMENSIONS, EXTERNAL:

Wing span 9.35 m (30 ft 8 in)
Length overall 6.50 m (21 ft 4 in)
Height overall 1.80 m (5 ft 10 3/4 in)

DIMENSIONS, INTERNAL:

Cabin max width 1.10 m (3 ft 7 1/4 in)

AREAS:

Wings, gross 11.50 m² (123.8 sq ft)

WEIGHTS AND LOADINGS (Rotax 912 ULS and parachute):

Weight empty 264 kg (582 lb)
Max T-O weight: Ultralight 472.5 kg (1,041 lb)
Experimental 560 kg (1,234 lb)

PERFORMANCE (with Rotax 912 ULS engine):

Never-exceed speed (VNE) 135 kt (250 km/h; 155 mph)
Max operating speed (VMO) 119 kt (220 km/h; 137 mph)
Cruising speed at 75% power 113 kt (210 km/h; 130 mph)
Stalling speed, flaps 10° 34 kt (62 km/h; 39 mph)
Max rate of climb at S/L 510 m (1,673 ft)/min
T-O run 150 m (495 ft)
Landing run 100 m (330 ft)
Range 510 n miles (945 km; 587 miles)

AVYRON**AVYRON**

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Web: www.avyron.com

MANAGER: Jean-Luc Journo

SALES MANAGER: Georges Chemla

New Avyron company announced its intention of producing a development of Grinvalds Orion at Paris Air Show in June 2005.



Prototype Grinvalds G-801 above the Avyron stand at Paris in June 2005
(Paul Jackson)

1129260

AVYRON JG-803

TYPE: Four-seat kitbuilt.

PROGRAMME: Design initiated by Jean Grinvalds in 1975; G-801 Orion (F-PYKF) first flew 2 June 1981 as two-seater with 48.5 kW (65 hp) engine; developed G-802 (134 kW; 180 hp Textron Lycoming IO-360) followed 4 November 1983; marketed as kit or plans by Aérodis of France; further small number of kits sold by Aerodis America Inc. Programme transferred to Avyron and improved JG-803 launched at Paris Air Show in June 2005. Prototype then under construction. Kits to be manufactured in Switzerland.

CURRENT VERSIONS: **G-190:** Powered by 142 kW (190 hp) Mazda (Mistral Engines modified) rotary Diesel engine.

G-230: With 172 kW (230 shp) Innodyn turboprop.

COSTS: Prices not finalised by early 2006.

DESIGN FEATURES: Low-wing, mid-engined pusher with T tail. JG-803 is fly-by-wire version with increased carbon fibre content.

FLYING CONTROLS: Electronic. Flaps; max deflection 35°.

STRUCTURE: Glass fibre wing with Kevlar and carbon fibre reinforcement; landing gear attached to rear spar; aluminium fuel tanks in prototype; integral tanks in production version. Carbon fibre fuselage and propeller drive shaft.

Wing section NACA 43015 at root; NACA 43012 at tip. Dihedral 4° 30'; incidence 2° 30' at root. Tailplane NACA 09; no incidence.

LANDING GEAR: Tricycle type; retractable. Mainwheels retract inwards; nosewheel forward. Electric actuation standard; hydraulic optional; manual emergency handle.

POWER PLANT: One Jet A-1-fuelled engine behind cabin, driving pusher propeller in extreme tail. Fuel tank in each wing; combined capacity 180 litres (47.5 US gallons; 39.6 Imp gallons).

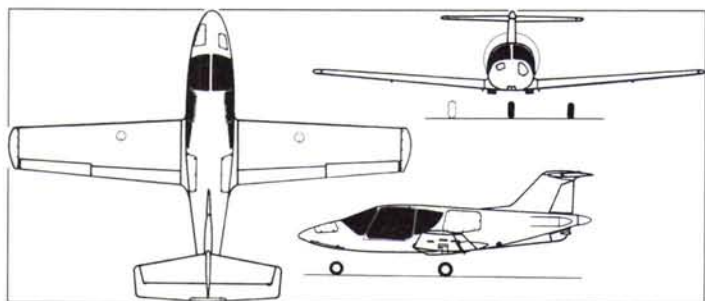
ACCOMMODATION: Four persons in side-by-side tandem pairs. Upward-hinged door each side. Tinted Plexiglas windows.

AVIONICS: EFCS.

EQUIPMENT: Ballistic recovery parachute.

DIMENSIONS, EXTERNAL:

Wing span 8.90 m (29 ft 2 1/2 in)
Wing chord: at root 1.50 m (4 ft 11 in)
at tip 1.00 m (3 ft 3 1/4 in)
Wing aspect ratio 7.1
Length: fuselage 6.70 m (21 ft 11 3/4 in)
overall 6.85 m (22 ft 5 3/4 in)
Height overall 2.55 m (8 ft 4 1/2 in)
Tailplane span 3.30 m (10 ft 10 in)
Wheel track 2.90 m (9 ft 6 1/4 in)
Wheelbase 2.55 m (8 ft 4 1/2 in)
Doors (each): Height 0.75 m (2 ft 5 1/2 in)
Width: max 0.90 m (29 ft 6 1/4 in)
min 0.65 m (2 ft 1 1/2 in)



Avyron JG-803 four-seat kitbuilt

1129162

DIMENSIONS, INTERNAL:

Cabin: Length 2.30 m (7 ft 6 1/2 in)
Max width 1.10 m (3 ft 7 1/4 in)
Max height 1.05 m (3 ft 3 1/4 in)

AREAS:

Wings, gross 11.12 m² (119.7 sq ft)
Ailerons (total) 0.86 m² (9.26 sq ft)
Trailing-edge flaps (total) 1.22 m² (13.13 sq ft)
Fin 1.10 m² (11.84 sq ft)
Underfin 0.18 m² (1.94 sq ft)
Rudder, incl tab 0.30 m² (3.23 sq ft)
Tailplane 3.13 m² (33.69 sq ft)

WEIGHTS AND LOADINGS (G-190):

Weight empty 610 kg (1,345 lb)
Max T-O weight 1,050 kg (2,314 lb)
Max wing loading 94.4 kg/m² (19.57 lb/sq ft)
Max power loading: G-190 4.21 kg/kW (6.92 lb/hp)
G-230 6.12 kg/kW (10.06 lb/shp)

PERFORMANCE (estimated):

Max level speed: G-190 189 kt (350 km/h; 217 mph)
G-230 194 kt (360 km/h; 224 mph)
Cruising speed at 75% power: G-190 173 kt (320 km/h; 199 mph)
G-230 178 kt (330 km/h; 205 mph)
Stalling speed, flaps down 49 kt (90 km/h; 55 mph)
Max rate of climb at S/L 270 m (886 ft)/min
Service ceiling 4,500 m (14,760 ft)
Range 1,619 n miles (3,000 km; 1,864 miles)

BEST OFF**BEST OFF**

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DIRECTOR: Philippe Prevot

NORTH AMERICAN AGENTS:

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Web: www.skyrangeraircraft.com

This company holds rights to the Sky Ranger ultralight, which is built under licence in Ukraine by Aeros and distributed by several dealerships throughout the world.

BEST OFF SKY RANGER

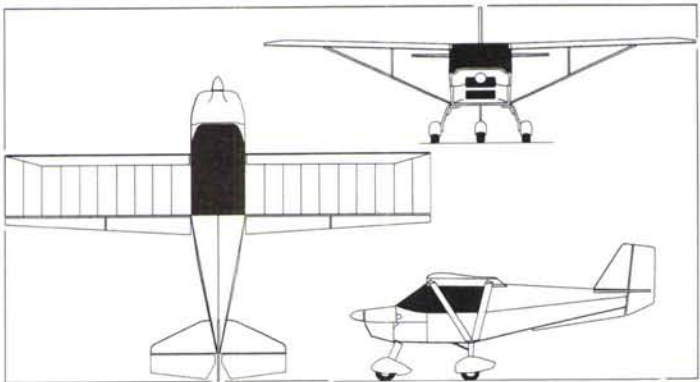
TYPE: Side-by-side ultralight kitbuilt.
PROGRAMME: Designed in Toulouse, France, in 1990 by Philippe Prevot; winner of World FAI two-seat ultralight championships in 1996, 1999 and 2003, plus silver medal in European ultralight championship in 2002 and 2004. After production of 200 by Synairgie in France, between 1992 and 1997, manufacture was transferred to Aeros in 1998; current version is Sky Ranger 2, offered in two versions: standard **V.Fun** and BCAR section S-compliant **V.Max**. Tailwheel and short-wing options added to range in 2006; short wing **Swift** developed in UK by Flylight and announced at Popham Microlight Fair, 29 April 2006. Prototype (G-UPHI) first flew October 2006.
CUSTOMERS: Over 950 (including 200 of first series) delivered by early 2006.
COSTS: V.Fun kit EUR11,800, engine EUR12,000 extra; V.Max kit EUR12,800, engine EUR12,000 extra, all excluding taxes (2006).
DESIGN FEATURES: Intended to combine high performance with simple construction. Delivered as fast-build kit, assembled by two persons in two weeks. Wings foldable for storage by two persons in 20 minutes.
High wing with V-strut bracing and auxiliary struts; wire-braced empennage. Purpose-designed wing section. Directional stability enhanced from 2003 onwards by addition of



Best Off Sky Ranger nosewheel version (Paul Jackson) 1159340



Best Off Sky Ranger Swift 912S developed in UK (Paul Jackson) 1040498



Best Off Sky Ranger side-by-side ultralight (Paul Jackson) 1159375

large underfin, although this quickly changed to revised design comprising smaller underfin and flush, downward extension of rudder. US aircraft also have downward extension to rudder.
FLYING CONTROLS: Conventional and manual; cable operated. Three-position flaps: pushrod actuated.
STRUCTURE: Employs only straight 2024 and 2017 aluminium tubing; no bends or welds; fabric covering, except for composites engine cowl and forward fuselage. No composites in structural elements. Other parts of stainless steel and plated mild steel. Optional composites wingtips.
LANDING GEAR: Tricycle type; fixed. Spring steel cantilever mainwheel legs with drag bracing tubes attached to lower longerons. All tyres 4.00 6. Cantilever-sprung main legs. Hydraulic disc brakes. Optional wheel fairings and floats.
POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL, with 1:2.27 gearing in highest-powered version. Rotax 503, 582, 912 UL-S (France only), BMW, Simoncini, HKS 700E and Jabiru 2200 are alternatives. Three-blade, ground-adjustable pitch propeller. Fuel capacity 50 litres (13.2 US gallons; 11.0 Imp gallons) in tank behind seats.
DIMENSIONS, EXTERNAL:
Wing span 9.50 m (31 ft 2 in)
Length overall 5.50 m (18 ft 0½ in)
Height overall 2.00 m (6 ft 6¾ in)
AREAS:
Wings, gross 14.10 m² (151.8 sq ft)
WEIGHTS AND LOADINGS (Rotax 912 engine):
Weight empty 250 kg (551 lb)
Max T-O weight (where allowed) 560 kg (1,234 lb)
PERFORMANCE (Rotax 912 engine):
Never-exceed speed (VNE) 107 kt (199 km/h; 124 mph)
Max cruising speed 87 kt (161 km/h; 100 mph)
Stalling speed, flaps down 33 kt (60 km/h; 37 mph)
Max rate of climb at S/L 274 m (900 ft)/min
T-O run 90 m (295 ft)
Landing run 120 m (394 ft)
g limits (ultimate) +6/-4
PERFORMANCE, UNPOWERED:
Glide ratio 9:1

CAP

CAP AVIATION

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Web: www.capaviation.com
PRESIDENT, CEO AND HEAD OF DESIGN: Dominique Roland
SALES MANAGER, EUROPE: Alain Ruelloux

CAP Aviation (renamed from Akrotech Europe in January 1999) is owned by holding company Apex International (formerly known as Aéronautique Service — AES) (which see), also responsible for the Robin and BUL concerns. It formed in 1997, initially to market the Giles G-202 two-seat aerobatic aircraft, subsequently marketed in factory-completed form as the CAP 222.

Apex took over production of the Mudry series of aerobatic aircraft on 12 May 1997 following that company's bankruptcy. All aerobatic aircraft produced by Apex are marketed by CAP Aviation: the CAP 232 built at Bernay until transferred to Darois in mid-2005; and CAP 10 at Darois. CAP 222 has been discontinued.

CAP Aviation's parent company, Apex Aircraft, emerged from voluntary receivership on 25 August 2003.

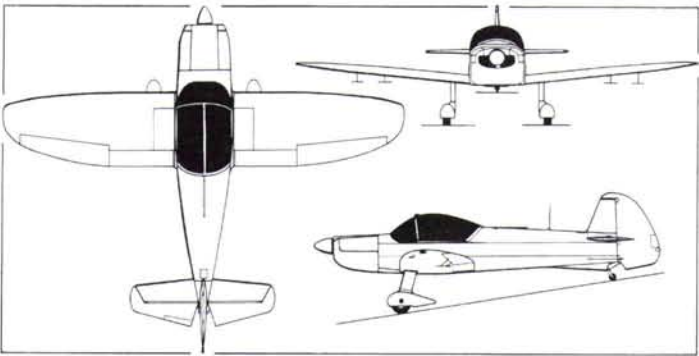
CAP 10

TYPE: Aerobatic two-seat sportplane.
PROGRAMME: Derived from Piel CP-30/CP-301 Emeraude, first flown 19 June 1954 and built by amateur constructors as well as by 11 commercial plants, under various names. Super Emeraude modified with taller fin and 119 kW (160 hp) engine as CP-100 prototype, flown 13 August 1966; with broader chord rudder and 134 kW (180 hp) engine, became prototype CAP 10 B, first flight (F-WOPX) 22 August 1968; further three pre-series aircraft; certified 4 September 1970; FAA certification for day and night VFR on 13 June 1974. Produced by Mudry until 1996.
Production transferred to Dijon, beginning with CAP 10 C in 2001. Total fleet time exceeded 500,000 flight hours by 2005.
CURRENT VERSIONS: **CAP 10 B**: Previous version; now out of production, but can be upgraded to CAP 10 C in one day's work.
CAP 10 C: Announced in early 1999; features carbon fibre-reinforced wing spar (Mod 000302) for reduced weight and increased speed and roll rate.
Improvements effected in CAP 10 C include substitution of pushrods for aileron control, replacing cables; larger (25 per cent) ailerons of increased chord with repositioned axis for



CAP 10 C owned by Mr I Valentine (Paul Jackson) 1042959

faster roll rate, compensated by two spade-type servos per side; aileron max 'down' deflection increased from 15 to 25°; electric actuation of flaps; electric fuel gauges and flush filler caps; optional constant-speed propeller (in prospect); upgraded instrumentation with four standard options; redesigned landing gear to improve ground handling; local airframe reinforcement and landing gear attachments; and revised canopy design to reduce cockpit noise levels. Roll rate improved by 30 per cent. New wing available for retrofitting to existing CAP 10 Bs and is supplied complete with landing gear.
Static test of wing undertaken 27 April 2000; prototype first flight (CAP 10 B HB-SAX retrofitted with new wing) 5 March 2001; first 'true' CAP 10 C (F-WWNN, c/n 300) first flown 15 May 2001 and following initial flight testing was delivered to CEV during July. DGAC certification achieved in early 2002. Reregistered F-GYKA on completion of trials. CAP 10Cs are registered under CAP 10B type certificate. FAA certification achieved 16 June 2004.
Description refers to CAP 10 C unless otherwise stated.
CUSTOMERS: Total 284 of earlier versions (including prototypes) built to mid-1999, of which 279 completed by Mudry before 1996 bankruptcy. Final five produced by Akrotech Europe in temporary factory at Bernay and include exports to UK (three) and USA (one); last, in 1999, was G-LORN (c/n 282) to UK. Production then paused, pending launch of CAP 10 C and transfer of production to Dijon. Previous major users, French Air Force (56) and Mexican Air Force (20) began disposals in 1994-95. Two more recent aircraft operated by 208 Squadron of South Korean Air Force; French Navy has eight.
First production CAP 10 C (c/n 301; G-CPXC) registered in December 2001 to Cole Aviation in UK; 14th registered in November 2004; 15th in 2005; customers include SEFA of France (five). By mid-2004 an additional 45 sets of CAP 10 C wings had been sold to existing CAP 10 B operators.
COSTS: EUR162,320 to EUR185,274 depending on equipment level (2004).



CAP 10 C, showing new ailerons (Paul Jackson) 013720*

DESIGN FEATURES: Simple, sporting lightplane with low, basically elliptical wing, mid-mounted tailplane and curved rudder.

Wing section NACA 23012; dihedral 5°; incidence 0°.

FLYING CONTROLS: Conventional and manual. Electric trim tabs on port elevator; balance tab on rudder; tailplane incidence adjustable on ground; electric three-position (0, 15, 40°) flaps. Control surface deflections: ailerons +25°–25°, elevators ±25°, rudder ±18°.

STRUCTURE: Main spar of carbon fibre caps and birch ply webs; wooden ribs; birch ply skin; carbon fibre wingtips; birch ply ailerons, flaps, fin/rudder and tailplane/elevator. Wooden fuselage, with okoumé ply upper decking and polyester fabric covering elsewhere.

LANDING GEAR: Tailwheel type; fixed. Wing-mounted, trousered, cantilever main legs of light alloy, with integral ERAM type 9 270 C oleo-pneumatic shock-absorbers. Single wheel on each main unit, tyre size 380x150/15x6.00-5. Solid tailwheel tyre, size 6x2.00. Tailwheel is steerable by rudder linkage but can be disengaged for ground manoeuvring. Hydraulically actuated mainwheel disc brakes (controllable from port seat) and parking brake. Dual toe brakes standard. Streamline fairings on mainwheels and legs.

POWER PLANT: One 134 kW (180 hp) Textron Lycoming AEIO-360-B2F flat-four engine, driving a Hoffmann HO29HM-189 170 two-blade, fixed-pitch wooden propeller; optional Evra 3,180-170-H5.F. Standard fuel tank aft of engine fireproof bulkhead, usable capacity 72 litres (19.0 US gallons; 15.8 Imp gallons); total 75 litres (19.8 US gallons; 16.5 Imp gallons). Auxiliary tank, usable capacity 78 litres (20.6 US gallons; 17.2 Imp gallons), total capacity 79 litres (20.8 US gallons; 17.3 Imp gallons), beneath baggage compartment, must be empty for aerobatics. Inverted fuel and oil (Aviat/Christen) systems permit continuous inverted flight.

ACCOMMODATION: Side-by-side adjustable seats for two persons, with provision for back parachutes, under rearward-sliding and jettisonable moulded transparent canopy. Five-point aerobatic shoulder harness standard. Leather upholstery optional. Space for 20 kg (44 lb) of baggage aft of seats in training and touring models.

SYSTEMS: Electrical system includes Delco-Remy 40 A engine-driven alternator and STECO ET24 Ni/Cd battery.

AVIONICS: Bendix/King and Garmin suites optional.

Comms: Optional KY97A VHF com; GMA 340 audio panel and Sigtronics SPA400 intercom; GTX 320 or GTX 327 transponder; ACK 30 encoder; EBC 102A ELT.

Flight: Garmin GNC 250 XL, GNS 420 or GNS 430 GPS; GI 106A VOR/ILS; Sandel SN3308 EHSL.

Instrumentation: ASI (kt and mph); altimeter; VSI; recording g-meter; positive/negative slip indicator; compass; tachometer; fuel gauges; oil pressure/temperature, EGT and CHT gauges; and manifold pressure/fuel flow gauge, all standard. Artificial horizon, turn co-ordinator, and directional gyro optional or standard according to selected equipment fit level.

Equipment: Panel light, cockpit light, landing light, navigation and strobe lights, external power socket, aerobatic sighting device, and canopy cover, all optional.

DIMENSIONS, EXTERNAL:

Wing span	8.08 m (26 ft 6 in)
Wing aspect ratio	6.0
Length overall	7.16 m (23 ft 6 in)
Height overall	2.55 m (8 ft 4½ in)
Tailplane span	2.90 m (9 ft 6 in)
Wheelbase	4.30 m (14 ft 1¼ in)
Wheel track	2.06 m (6 ft 9 in)

Propeller diameter	1.90 m (6 ft 2¾ in)
DIMENSIONS, INTERNAL:	
Cabin: Length	1.05 m (3 ft 5½ in)
Max width	1.05 m (3 ft 5½ in)
Max height	0.98 m (3 ft 2½ in)
AREAS:	
Wings, gross	10.85 m² (116.8 sq ft)
Vertical tail surfaces (total)	1.32 m² (14.25 sq ft)
Horizontal tail surfaces (total)	1.86 m² (20.02 sq ft)
WEIGHTS AND LOADINGS (A: Aerobatic, U: Utility):	
Weight empty, equipped	540 kg (1,190 lb)
Max baggage weight: A	nil
U	50 kg (110 lb)
Fuel weight: A	54 kg (119 lb)
U	108 kg (238 lb)
Max T-O weight: A	780 kg (1,719 lb)
U	830 kg (1,830 lb)
Max landing weight	800 kg (1,764 lb)
Max wing loading: A	71.9 kg/m² (14.72 lb/sq ft)
U	76.5 kg/m² (15.67 lb/sq ft)
Max power loading: A	5.82 kg/kW (9.56 lb/hp)
U	6.19 kg/kW (10.16 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	183 kt (340 km/h; 211 mph)
Max level speed at S/L and cruising speed at 75% power at FL80	148 kt (274 km/h; 170 mph)
Stalling speed: clean	53 kt (99 km/h; 61 mph)
flaps down	46 kt (85 km/h; 53 mph) IAS
Max rate of climb at S/L	488 m (1,600 ft)/min
Service ceiling	5,000 m (16,400 ft)
T-O run	350 m (1,150 ft)
T-O to 15 m (50 ft)	395 m (1,300 ft)
Landing from 15 m (50 ft)	600 m (1,970 ft)
Landing run	360 m (1,185 ft)
Range with max fuel	521 n miles (965 km; 600 miles)
g limits: A	+6/-4
U	+4,-1.8

CAP 232

TYPE: Aerobatic single-seat sportplane.

PROGRAMME: Prototype (F-WZCH) first flew 7 July 1994; French certification and first sales March 1995; initial production aircraft (No. 02/F-GPRC) first flew 9 April 1995. First place in 2000 World Aerobatic Championship in France was taken by Eric Vazeille in CAP 232 F-GKDX; Catherine Maunoury was fifth (women's first) in F-GXCM. Production transfer of CAP 232 from Bernay to Darois announced June 2005.

CUSTOMERS: Total 44 built by late 2004, including prototype, one destroyed before first flight and one crashed on test; no known production in 2005. Mainly to French civil register (19) and four to French Air Force, but others sold to Australia (one, 1996 and USA eight). Others employed in Switzerland and UK, but retaining French registry. Moroccan Air Force placed order for nine in mid-2000 to re-equip Marche Verte aerobatic team; deliveries were completed between early 2001 and 2004.

COSTS: US\$250,000 (2001).

DESIGN FEATURES: Optimised for world-class aerobatic competition. Similar to, and improvement on, CAP 231 EX. Strong, carbon fibre wing of broad root chord, sharply tapered for high roll rates; tapered tail surfaces.

FLYING CONTROLS: Conventional and manual. Electrically actuated elevator tab; elevator servo tab to reduce stick forces. Almost full-span ailerons for high roll rates.

STRUCTURE: Two-spar carbon fibre wings; 10 ribs.

LANDING GEAR: Fixed tailwheel type; fuselage-mounted cantilever mainwheel legs with wheel fairings. Mainwheel tyres 5.00-5.

POWER PLANT: One 224 kW (300 hp) Textron Lycoming AEIO-540-L1B5D flat-six engine, driving a variable-pitch (hydraulic) MT-Propeller MTV-14-BC-C190-17 four-blade propeller. Total fuel capacity 189.3 litres (50.0 US gallons; 41.6 Imp gallons) in one fuselage tank and two wing tanks. Fuel and oil system designed for prolonged inverted flight.

ACCOMMODATION: Single seat under rear-hinged canopy. Baggage space behind pilot.

SYSTEMS: Electrical system includes engine-driven alternator and 12 V 60 Ah battery.



French Air Force CAP 232 aerobatic sportplane (Paul Jackson) 1153750

AVIONICS: Customer specified.

Comms: Radio and transponder optional.

Flight: GPS optional.

EQUIPMENT: Sighting frame can be attached to wingtip for judging exact verticals in competition aerobatics.

DIMENSIONS, EXTERNAL:

Wing span	7.39 m (24 ft 3 in)
Wing chord: at root	1.83 m (6 ft 0 in)
at tip	0.91 m (3 ft 0 in)
Wing aspect ratio	5.4
Length overall	6.76 m (22 ft 2 in)
Tailplane span	2.74 m (9 ft 0 in)
Wheel track	1.75 m (5 ft 9 in)
Propeller diameter	1.90 m (6 ft 2 3/4 in)
Propeller ground clearance	0.30 m (1 ft 0 in)

AREAS:

Wings, gross	10.15 m ² (109.3 sq ft)
Ailerons (total)	1.00 m ² (10.76 sq ft)
Fin	0.55 m ² (5.92 sq ft)
Rudder	0.77 m ² (8.29 sq ft)
Tailplane	1.02 m ² (10.99 sq ft)
Elevators	1.11 m ² (11.93 sq ft)

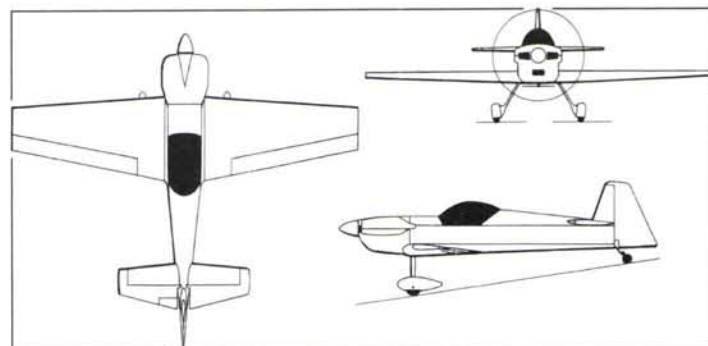
WEIGHTS AND LOADINGS (A: Aerobatic, N: Normal category):

Weight empty	585 kg (1,290 lb)
Max payload	227 kg (500 lb)
Fuel weight	123 kg (270 lb)
Max T-O and landing weight: N	730 kg (1,610 lb) ¹
A	821 kg (1,810 lb) ¹
Max wing loading	80.9 kg/m ² (16.56 lb/sq ft)
Max power loading	3.67 kg/kW (6.03 lb/hp)

¹ As quoted by manufacturer

PERFORMANCE:

Never-exceed speed (VNE)	219 kt (405 km/h; 252 mph)
Max level speed	189 kt (349 km/h; 217 mph)



CAP Aviation CAP 232 (Paul Jackson)

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Max cruising speed at 75% power	174 kt (322 km/h; 200 mph)
Manoeuvre speed (V _A)	170 kt (314 km/h; 195 mph)
Econ cruising speed	145 kt (269 km/h; 167 mph)
Stalling speed, power off	56 kt (104 km/h; 65 mph)
Max rate of climb at S/L	1,003 m (3,290 ft)/min
Rate of roll at manoeuvre speed	420°/s
Service ceiling	4,575 m (15,000 ft)
T-O run	150 m (495 ft)
T-O to 15 m (50 ft)	180 m (595 ft)
Landing from 15 m (50 ft)	450 m (1,480 ft)
Range with max fuel, 45% power	650 n miles (1,203 km; 748 miles)
g limits	±10

DASSAULT

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HONORARY CHAIRMAN: Serge Dassault

CHAIRMAN AND CEO: Charles Edelstenne

VICE-CHAIRMAN: Bruno Revellin-Falcoz

SENIOR EXECUTIVE VICE-PRESIDENT, OPERATIONS: Christian Decaix

SENIOR EXECUTIVE VICE-PRESIDENT, INTERNATIONAL: Bruno Cotté

VICE-PRESIDENT, COMMUNICATIONS: Gérard David

INFORMATION OFFICER: Luc Berger

Former Avions Marcel Dassault-Breguet Aviation formed from merger of Dassault and Breguet aircraft companies in December 1971; French government acquired 20 per cent of stock in January 1979, raised to 45.76 per cent in November 1981; present company name adopted June 1990.

Dassault Aviation is owned 50.21 per cent by Dassault Group; 46.22 per cent by EADS France; and 3.57 per cent by others.

Global employees total some 12,040, mostly at 10 French industrial sites: St Cloud, Argenteuil, Argonay, Biarritz, Mérignac, Martignas, Istres, Cazaux, Poitiers and Seclin. Consolidated orders in 2004 amounted to EUR4.02 billion, with 66 per cent exports. Dassault sold 69 Falcon business jets in 2004.

Work began on 16 September 2002 on new manufacturing building at Bordeaux for Falcon 7X. Three Falcon 7X prototypes flew in 2005. Signed co-operation accord with Sukhoi of Russia in June 2003, collaborative opportunities including supersonic business jet, corporate shuttle aircraft and UAVs.

Dassault assembles and tests its civil and military aircraft in its own factories, but operates wide network of subcontractors. Other products include flight control system components, maintenance and support equipment. Related companies include Dassault Falcon Jet Corporation, Dassault Falcon Service and SOGITEC. All are subordinate to Groupe Industriel Marcel Dassault, previously including Dassault Electronique, which became part of Thomson-



Special 'Tiger' colour scheme on a Mirage 2000C of EC 1/12, French Air Force (Jean-Louis Gaynecoetche)

1153764

CSF Detexis (now Thales) on 1 January 1999. Falcon Jet Corporation has HQ and completion centre at Little Rock and service centres in North and South America; workforce 2,300 in 2005.

European Aerosystems Ltd established with BAE Systems as a joint venture military aircraft company. On 5 July 2002, Dassault, EADS CASA, EADS Military Aircraft and Saab signed industrial collaboration agreement for feasibility study of Advanced European Jet Pilot Training system.

Dassault has produced more than 1,650 executive jets for service in 65 countries and received orders for over 2,700 Mirages of all types. The company has delivered some 7,500 aircraft to 75 countries and these have accumulated 20 million flying hours.

DASSAULT CONSOLIDATED SALES TRENDS (EUR MILLION)

DEFENCE					
Fiscal year	France	Export	Falcon	Total	% Export
1999	780	149	1,960	2,889	68%
2000	864	147	2,474	3,485	73%
2001	653	164	2,653	3,470	77%
2002	1,053	158	2,226	3,437	66%
2003	545	1,061	1,692	3,298	82%
2004	505	838	2,116	3,459	83%

DASSAULT MIRAGE 2000

Indian Air Force name: Vajra (Divine Thunder)

TYPE: Multirole fighter.

PROGRAMME:

DEVELOPMENT MILESTONES

Mirage 2000C

Official go-ahead	18 Dec 75
First flight	10 Mar 78
First flight, production	20 Nov 82
Entered service (EC 1/2)	2 Jul 84

Subsequent versions:

Mirage 2000N

First flight	3 Feb 83
First flight, production	3 Mar 83
First delivery	30 Mar 88
Entered service (EC 1/4)	1 Jul 88

Mirage 2000D

First flight	19 Feb 91
First delivery (CEAM)	9 Apr 93
Entered service (EC 1/3)	29 Jul 93

Mirage 2000-5

First flight	24 Oct 90
First flight, production	Oct 95
First delivery (Taiwan)	May 97

Mirage 2000-9

First flight	14 Dec 00
First delivery (Abu Dhabi)	14 Apr 03

Selected as main French Air Force combat aircraft 18 December 1975; first of four single-seat prototypes flew 10 March 1978, followed by two-seat version on 11 October 1980; initially developed as interceptor with SNECMA M53 power plant and Thomson-CSF (now Thales) RDM multimode pulse Doppler radar; M53-5 in early production aircraft succeeded by M53-P2; fitted with RDI radar from 38th French Air Force 2000C onwards;



French Air Force Dassault Mirage 2000B (Paul Jackson)

1153766

first flight of production 2000C 20 November 1982; first flight of production two-seat 2000B, 7 October 1983; first unit, EC 1/2 'Cigognes', formed at Dijon 2 July 1984. Subsequently developed for strike/attack as 2000N/D.

Second-generation Mirage 2000-5 first flown as prototype 24 October 1990; initial production aircraft flown in October 1995 and type qualification granted (for SF1 French production standard) by DGA procurement agency on 13 June 1997; initial export delivery in May 1997, followed by first to French Air Force in December 1997. By end of 2004, Mirage 2000s of eight air forces had accumulated 1.2 million flying hours.

Third-generation Mirage 2000-5 Mk 2 launched in April 1999; first flew December 2000; deliveries began April 2003.

Potential engine upgrade revealed in early 2000; M53 PX3 under study to provide additional 8 to 10 per cent thrust. PX3 offered to Brazil for Mirage 2000BR in 2002.

CURRENT VERSIONS: **2000B:** (Biplane: two-seat). Trainer counterpart of 2000C; Nos. 501 to 514 (Series) S3 with RDM radar and M53-5 power plant; Nos. 515 to 520, S4 with RDI J1-1 radar and M53-5, but Nos. 516 and 517 retrofitted with RDM; No. 521 S4-2 with RDI J2-4 and M53-5; No. 522 also S4-2, but M53-P2; Nos. 523 to 530 S5 with RDI J3-13 and M53-P2. Final delivery in December 1994. See also Mirage 2000DA below. One or two Mirage 2000Bs distributed to each 2000C operating squadron, but most operated by OCU, EC 2/5 at Orange, which assumed task from EC 2/2 at Dijon on 1 July 1998. S3 aircraft have been upgraded with RDI radar, French holding in 2005 being nine S4-2A/M53-5, six S5-2C/M53-5 and three S5-2C/M53-P2.

2000BR: Version of 2000-5 Mk 2 proposed for Brazil, 2001, but new fighter competition was subsequently postponed. Development and promotion agreement signed by Dassault, Embraer, Snecma and Thales 27 March 2002. Total 48 had been required, of which 32 to be assembled locally by Embraer.

Alternative option adopted 16 July 2005 when Brazil ordered 12 ex-French Mirage 2000Cs (RDI radar) for EUR60 million; early delivery expected from surplus stocks held at Chateaudun maintenance depot.

2000C: (Chasseur: fighter). Standard interceptor; Nos. 1 to 37 built as series S1, S2 and S3 with RDM radar and M53-5 power plants; since upgraded to S3 radar standard. Loosely called Mirage **2000RDM**; Mirage 2000B and C collectively known as Mirage **2000DA** (*Défense Aérienne*). Later aircraft (loosely **2000RDI**) have RDI radar and M53-P2 power plants; Nos. 38 to 48 Series S4, delivered from July 1987 and later upgraded to S4-1; Nos. 49 to 63 S4-1; Nos. 64 to 74 S4-2; Nos. 75 to 124 Series S5, delivered between late 1990 and June 1995. Equipment standards of Mirage 2000B/Cs are S3, incapable of launching Matra BAe 530D (530F only); S4 RDI J1-1 radar; S4-1 retrofit of all S4s with improved J1-2; S4-2 further radar upgrade to J2-4; S4-2A retrofit of all S4-1 and S4-2 aircraft (Nos. 38 to 74, 515 and 518 to 522) with improved J2-5 radar; S5 definitive standard with J3-13 radar and, from No. 93 onwards, Spirale chaff/flare dispenser; and S5-2C retrofit introduced 1995 (aircraft of EC 1/12) providing better anti-jamming protection for RDI radar. Conversion completed of 37 2000B/Cs to Mirage 2000-5F (which see). Withdrawal of S3 began in January 1998 for upgrading with RDI radar and final aircraft returned to service (at Orange) in March 1999; EC 2/2 gained late production (RDI) aircraft, with which it became operational in the air defence role on 1 August 1998. By 2005, Cambrai squadrons (EC 1/12 and 2/12) operating S5-2C aircraft and Orange squadrons (EC 1/5 and 2/5) S4-2A.

Detailed description applies to 2000C except where indicated.

2000D: Two-seat conventional attack version of 2000N, lacking ASMP missile interface and nose pitot but with HOTAS controls, additional display screens for both crew members, Antelope 5-3D terrain-following/terrain-reference radar, GPS and improved (ICMS Mk 2) ECM; functions of pilot and navigator more clearly demarcated. First flight (D01, ex-N01) 19 February 1991; second prototype, D02 (ex-N02), flown 24 February 1992; first 2000D (No. 601) delivered CEAM Mont-de-Marsan for trials 9 April 1993; first squadron, EC 1/3 'Navarre', achieved limited IOC (six aircraft only) 29 July 1993 at CEAM. Combat debut was 5 September 1995, launching AS 30L ASMs in Bosnia. Last of 86 delivered February 2002.

Initial six aircraft built to 'interim baseline' configuration known as **R1N1L**, with ability to launch AS-30 laser-guided ASM and Magic AAM only. Further 18 (Nos. 607 to 624), designated **R1N1**, had only 'classic' (free-fall, non-laser) options. Later **R1** aircraft (No. 625 onwards) have full range of current French Air Force armament (BAP 100, BAT 120, Belouga, 68 mm rockets, AS 30L, GBU-12 (Mk 82), BGL 1000, Magic 2 and PDLCT designator). Deliveries of new aircraft ended in December 2001. PDLCT-S (*Synergie*), first employed over Yugoslavia in March 1999, is modified version with improved imagery contrast. All interim 2000Ds were modified to full R1 standard by June 1995. **R2** standard, operational July 2001 (as R2.1), introduced improved navigation system. Eclair fully integrated self-defence suite and Atlas II laser designator pods (from Jaguar force) for use with Paveway II and III bombs; APACHE capability was added in late 2003. First two R2 conversions completed early 2000 at Nancy; further 18 followed, last in 2002. All aircraft to receive Thales RSA NG improved electronic warfare system. Planned **R3** version, with SCALP SOM and a reconnaissance pod, was abandoned in June 1996.

However, further enhancements implemented, including SCALP-EG (from October 2003) and MIDS/Link 16 datalink for NATO inter-operability (from early 2004). These enhancements form part of 'Post-R2' upgrade, which operational at Nancy from June 2004

on completion of 18th aircraft and due for completion in March 2006 with 80th machine. Related weapons, for NATO compatibility, include GBU-12/16/24 Paveway bombs. Self-protection includes Eclair IR/EM dispenser and DDM missile warning.

2000E: Multirole fighter for export; M53-P2 power plant throughout. Details in Customers subsection. Baseline version for India, Egypt and Peru, differences from 2000C including RDM radar with CW illumination for Super 530D AAM; two main computers, with expanded memory; ULISS 52 INS; improved ECM (integrated system with VCM-65 display or, alternatively, Remora and Caiman pods); VE-130 HUD; VMC-180 head-down; and expanded weapon options. Abu Dhabi and Greek 2000Es have extra computing power, further armament options and improved self-defence (SAMET system for Abu Dhabi; ICMS Mk 1 for Greece).

2000N: Two-seat low-altitude penetration version to deliver ASMP nuclear standoff missile; two prototypes; first flight 3 February 1983; one preseries aircraft (No. 301) built at Istres and first flown 3 March 1986; first 24 production aircraft (Nos. 302-325) were 2000N-K1 with ASMP capability only; from July 1988 remaining aircraft, designated 2000N-K2, have full conventional and ASMP capability; production ended 1993; all K1s (initially of squadrons 3/4 and part of 2/4) retrofitted to K2 for conventional attack, programme completed by late 1998. Equipment includes Antelope 5 terrain-following radar, two SAGEM inertial platforms, two improved AHV-12 radio altimeters, colour head-down CRT, two Magic self-defence missiles, and internal countermeasures system comprising Cameleon jamming system, Serval RWR and Spirale automatic chaff/flare dispenser system. Further improvement (K2-4C) in 2002 integrated self-defence systems with nav/attack system.

Follow-on upgrade, 2000N K3, launched in September 2003 for incorporation in 50 aircraft of EC 1/4, 2/4 and 3/4, gaining IOC in 2007. Thales Reco-NG reconnaissance pod; new self-protection avionics and upgraded ASMP-Ameliore (which authorised late 2000 for 2011 service entry).

2000N' (N Prime): Initial designation of 2000D.

2000R: Single-seat day/night reconnaissance export version of 2000E but with normal radar nose; various sensor pods possible (see Avionics paragraph).

2000-5: Multirole upgrade incorporating improvements from private venture Mirage 2000-3 project, plus Thales RDY radar and new central processing unit. Thales VEM 130F HUD and ICMS Mk 2 countermeasures; laser-guided bombs and ASMs in air-to-ground role; MICA AAM. First Mirage flight of RDY radar in BY1 (later numbered BY2) May 1988; first flight of full 2000-5 (two-seat) 24 October 1990 (same aircraft; initially no serial number; later reverted to B01); first single-seater, 01 (conversion of trials aircraft CY1) flown 27 April 1991.

Export orders from Taiwan and Qatar; air-to-air firing trials with MICA completed July 1996; air-to-ground trials completed May 1997; operational use (export; Taiwan) from June 1997.

FFr4.600 million (US\$830 million) conversion programme announced November 1992 for upgrading 37 French Air Force 2000Cs (34 S4-2As, Nos. 38 to 49, 51 to 59, 61 to 63 and 65 to 74 and three S5s, Nos. 77 to 79) mainly from EC 2/5 and 3/5 at Orange to **2000-5F** for continued service; contract awarded 25 November 1993; funding included only one reworked aircraft in 1994 defence budget; 10 more in 1995 funding; and 23 in 1996. Delivery schedule (not achieved) was one in 1997; 11 in 1998; 22 in 1999; and three in 2000; one lost on 16 March 1999. Rework (at Argenteuil, with reassembly at Bordeaux) required six months per aircraft and involved complete dismantling and return of fuselages to Argenteuil. RDI radars from these upgraded aircraft retrofitted in early production (RDM) Mirage 2000Cs. Prototypes were conversions of Nos. 51 and 77 (latter an S5); both modified at Istres; initial aircraft reflown 26 February 1996; second followed two months later.

First 'production' conversion, No. 38 handed over 30 December 1997 at Istres test centre before delivery in April 1998 to CEAM, Mont-de-Marsan, to begin conversion of pilots of EC 1/2 from Dijon. IOC at Dijon (12 aircraft) 31 March 1999; FOC 4 February 2000; re-equipment of EC 2/2 began late 1999; deliveries complete by 2001.

Identification features are additional (LAM) 'bullet' antenna on fin leading-edge, absence of nose pitot and four horizontal antenna bands on radome. Normal external configuration is two MICA and two Magic AAMs, plus two 2,000 litre (528 US gallon; 440 Imp gallon) and one 1,300 litre (343 US gallon; 286 Imp gallon) external tanks. Optional configuration (Standard Kilo) is four MICAs and two Magics. MICA delivered (first 25 rounds) in radar mode from August 1999 followed by IR version in 2003. Early 2000-5F deliveries were to SF1 standard; SF1C upgrade then followed, improving radar range by 15 per cent and adding non-co-operative target mode which analyses returns from target's engines. Follow-on upgrades projected with MIDS terminal for Link 16 datalink capability, IR version of MICA (SF1-IR from 2006) and provision for helmet-mounted sight.

2000-5 Mk 2: Announced April 1999; purchased initially by Greece. Features in common with 2000-9 include modular avionics, larger LCDs, secure communications, tactical datalink, additional decoy dispenser, laser gyro INS, upgraded ECM, expanded aircraft-missile datalink, Damoclès laser-designation pod (known as Shehab on 2000-9), Nahar navigational FLIR in Damoclès pylon, upgraded version of RDY radar (RDY2, with multitarget air-to-sea search and track, high-resolution SAR mapping mode and search and track of mobile land targets), increased MTOW of 17,500 kg (38,580 lb), new multichannel



Greek Dassault Mirage 2000BG (Jean-Louis Gaynecoetche)

1153744

digital recording system, new rear cockpit colour display repeater and, possibly, helmet-mounted sight. Can carry six MICA AAMs (active radar or IR) in addition to air-to-surface weapons.

2000-8: Mirage 2000EAD/RAD/DAD supplied to Abu Dhabi/UAE from 1989. Standard AD8.

2000-9: Version of 2000-5 for United Arab Emirates incorporating long-range air-to-ground capability with weapons including Black Shaheen SOM and Hakim allied to Damocles laser designator. Configuration includes M53-P2 engines, RDY-2 radar with synthetic aperture and beam-sharpening modes, Thales Totem 3000 laser INS and digital terrain system. First 2000-9s undertook flight testing and proving (three aircraft) at Istres from early 2001; first flight (DAD10; two-seat version) 14 December 2000; sole single-seat 2000-9RAD (RAD19) flew 25 January 2001. Further features, including retention of cannon, as for 2000-5 Mk 2. Upgrades of existing aircraft began in UAE in 2002. Second stage of 2000-9, AD92, integrates EMT1 modular data processing unit (DGTD/RTP M2000-X), replacing CP and BGS-type computers in earlier versions; also incorporates Elettronica IMEWS (integrated modular electronic warfare system).

FRENCH MIRAGE 2000 SQUADRONS

Squadron	Base	Type	Commissioned	Remarks
EC 1/2 'Cigognes'	Dijon	2000C (RDM)	2 Jul 84	Temp stood down Jan 98 ⁴
		2000-5F	31 Mar 99	Operational 4 Feb 00
EC 2/2 'Cote d'Or'	Dijon	2000B/C (RDM)	27 Jul 86	OCU until Jan 98
		2000C	1 Aug 98	
		2000-5F	2000	
EC 3/2 'Alsace'	Dijon	2000C (RDM)	Mar 86	Disbanded 31 Jul 93
EC 1/3 'Navarre'	Nancy	2000D	1 Apr 94 ¹	
EC 2/3 'Champagne'	Nancy	2000N	30 Aug 91	Conventional attack only
		2000D	24 Apr 97 ²	Converted 1996-98
EC 3/3 'Ardennes'	Nancy	2000D	21 Aug 95	
EC 1/4 'Dauphine'	Luxeuil	2000N	1 Jul 88	
EC 2/4 'La Fayette'	Luxeuil	2000N	1 Jul 89	
EC 3/4 'Limousin'	Istres	2000N	1 Jul 90	
EC 1/5 'Vendée'	Orange	2000C	1 Apr 89	
EC 2/5 'Ile de France'	Orange	2000C	1 Apr 90	
EC 3/5 'Comtat Venaissin'	Orange	2000B/C	1 Jul 98	OCU
		2000C	3 Sep 90 ³	Disbanded 31 Aug 97
EC 1/12 'Cambrésis'	Cambrai	2000C	1 Jul 92	
EC 2/12 'Picardie'	Cambrai	2000C	1 Sep 93	
EC 4/33 'Vexin'	Djibouti	2000C/D ⁵	5 Aug 2002	

¹ Limited IOC 29 Jul 93

² When only partly equipped with 2000D

³ First delivery

⁴ And equipped with Alpha Jets to maintain pilot currency

⁵ Multirole unit with five Mirage 2000Cs and three 2000Ds

⁶ To disband in 2008

CUSTOMERS: Refer to table for rapid reference. **France** required seven prototypes and 372 production aircraft; reduced in late 1991 to 318 by abandonment of final 24 2000Cs and 30 2000Ds and transfer of some single-seat aircraft to trainer contract; no Mirages funded in 1992 or 1993, but one 2000B and 14 2000Cs cancelled, then re-ordered in 1994 defence budget as 2000Ds. French orders subsequently amended to 30 2000Bs, 124 2000Cs, 75 2000Ns and 86 2000Ds (total 315); last in 2001. Mirage 2000C equipped three squadrons of EC 2 at Dijon (1984-86), three of EC 5 at Orange (1988-90) and two of EC 12 at Cambrai.

Mirage 2000N deliveries began at Luxeuil 30 March 1988; EC 1/4 'Dauphine' formed 1 July 1988, now with full dual-role K2 series aircraft, followed by two more squadrons. Pending 2000D, EC 2/3 'Champagne' operational at Nancy 1 September 1991 with 2000N in conventional role. EC 1/3 'Navarre' fully operational with 2000D from 31 March 1994; EC 3/3 'Ardennes' began re-equipment, July 1994; EC 2/3 began converting to 2000D (ex-2000N) in mid-1996, completing conversion in 1999. Mirage 2000N depot servicing required every 900 hours or 36 months, whichever sooner.

Abu Dhabi (United Arab Emirates) ordered 18 aircraft on 16 May 1983 and took up 18 options in 1985 for a total of 22 2000EADs, eight 2000RADs and six 2000DADs; these to Standard AD8; deliveries delayed from 1986 to 1989 by provision for US weapons such as

Sidewinder; deliveries to Maqatra/Al Dhafra completed November 1990 for Nos. 1 and 2 Shaheen (Warrior) Squadrons. Abu Dhabi 2000RADs carry COR2 multicamera pod, but alternatives include Raphaël-type SLAR 2000 or Harold pods; second 18 have Elettronica ELT/158 threat warning receivers and ELT/558 self-protection jammers; all with Spirale chaff/flare system. Self-defence suite code-named SAMET. Deliveries 7 November 1989 to November 1990. Weapons include BAE Systems PGM Hakim ASM.

Follow-on batch authorised in late 1996; reported 16 December 1997 as 30 new 2000-9s and upgrade to this standard of 33 earlier aircraft; contract signed 15 November 1998, becoming effective on 8 May 1999; new element later confirmed as 32 aircraft, while upgrades reduced by attrition to 30; total value estimated as USD3.4 billion for aircraft, or USD5.5 billion, including weapons and support. Weapons include Black Shaheen version of Storm Shadow/SCALP SOM, IR and active radar MICA AAMs; IMEWS, incorporating Spirale and Eclair ECM systems; Shebab target designator pod (export version of Damocles/PDLCT-S) and Nahar navigation FLIR mounted in starboard shoulder pylon. Retains HAROLD 1700 mm LOROP pod.

Prototypes flew December 2000 and February 2001; initial AD91 standard qualified 15 January 2003. Acceptances began at Bordeaux on 14 April 2003 with two new-build aircraft; first nine arrived in Abu Dhabi on 26 April 2003 and last 2004; first refurbished aircraft were received in June 2003; 12 accepted by 31 December 2004; last due late 2007. Early aircraft are Standard AD91 with MICA AAM capability; Standard AD92, with additional air-to-ground radar modes and weapons, plus reconnaissance capability, available from mid-2005 (testbeds: DAD11 and single-seat RAD19 retained by Dassault for AD92 trials, although these slowed by loss of DAD11 on 4 April 2005).

Egypt ordered 16 2000EMs and four BMs in December 1981; deliveries 30 June 1986 to January 1988; based at Beni Suef with 82 Squadron in interceptor role.

Greece ordered 36 2000EGs and four 2000BGs on 20 July 1985; handed over from 21 March 1988 and delivered from 27 April 1988 for 331 'Aegeas' and 332 'Geraki' Mire Pandos Kairou within 114 Pterix Mahis at Tanagra; deliveries suspended October 1989 at 28th aircraft; resumed 1992 and completed 18 November 1992. RDM3 radar; Spirale chaff/flare system installed, as part of ICMS self-defence suite; full ICMS system operational from August 1995. Some upgraded to 2000EG-SG3 standard with launch capability for AM 39 Exocet anti-ship missile.

Further 15 Mirage 2000-5 Mk 2s, including five two-seat, confirmed 30 April 1999 and formally ordered on 21 August 2000, together with upgrade to this standard of 10 earlier aircraft by HAL. Deliveries began to 332 Squadron on 12 July 2004, with equipment including RDY-2 radar, Thales Damocles laser designation pods and ICMS Mk 3. New weapons include MICA AAM (Standard EG 51) and SCALP EG ASM (EG 52). Final deliveries were expected in 2006, but option held on further three new aircraft and five upgrades.

India first ordered 36 2000Hs and four THs in October 1982; 26 Hs and four THs temporarily powered by M53-5; final 10 by M53-P2 from outset; first flight of 2000H (KF101) 21 September 1984; first flight of 2000TH (KT201) early 1985; No. 7 IAF Squadron 'Battle Axe' formed at Gwalior AB 29 June 1985, coincident with first arrivals in India. Named *Vajra* (Divine Thunder); second Indian order for six Hs and three THs signed March 1986 and delivered April 1987 to October 1988 to complete No. 1 'Tigers' Squadron. Third order placed 19 September 2000 for four 2000Hs and six 2000THs to be delivered in 2004, but THs held in storage pending resolution of dispute over avionics fit.

Despite grey-and-blue air defence camouflage, unconfirmed report claimed Indian Mirages optimised for attack, with Antelope 5 radar and twin INS. Role (at least) confirmed by 1996 selection (subject to operational trials) of the Rafael Litening laser-designator pod for IAF Mirage 2000s and Jaguars. By 1993 IAF aircraft appearing in experimental brown-and-green low-level colours, with Spirale chaff dispensers. By 1998, 38 remaining 2000Hs had been upgraded by HAL at Bangalore with local flare dispensers and were preparing for receipt of LGBs. In 2002, India planning acquisition of 126 Mirage 2000-5s to equip seven squadrons in strike role; final 108 would be assembled locally by HAL. Discussions continued into 2003, when India also announced intention of buying 12 aircraft from Qatar.

Peru ordered 24 2000Ps and two 2000DPs in December 1982, but reduced this to 10 2000Ps and two 2000DPs; first 2000DP handed over 7 June 1985; deliveries to Peru from December 1986; Escuadron de Caza-Bombardero 412 of Grupo Aéreo de Caza 4 at La Joya inaugurated 14 August 1987.

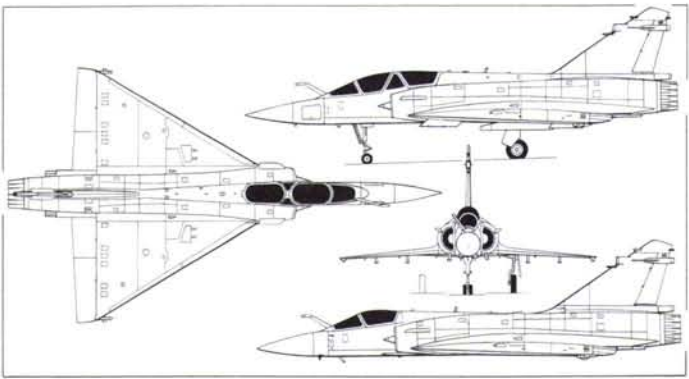
Qatar ordered 12 Mirage 2000-5s under contract 'Falcon' on 31 July 1994, together with MICA and Magic 2 AAMs. Versions are 2000-SEDA (nine; single-seat) and 2000-5DDA (three; two-seat). Equipment includes GPS, ICMS Mk 2 and provision for Spirale. First flight late 1995; first three handed over at Bordeaux on 8 September 1997; four delivered to Qatar 18 December 1997; four more on 1 April 1998. All 12 offered for sale to India in mid-2003; nothing further reported by late 2004.

Taiwan ordered 60 Mirage 2000-5s with M53-P2 power plants on 18 November 1992. First export sale for -5; first flight late 1995; first handed over on 9 May 1996 for training in France; initial five arrived in Taiwan as sea freight on 5 May 1997; equips 41, 42 and 48



Dassault Mirage 2000C (Paul Jackson)

1153765



Dassault Mirage 2000-5DDA, with added side view (bottom) of Mirage 2000-5Ei (Dennis Punnett) 0062696

Squadrons of 2nd Tactical Fighter Wing at Hsinchu; IOC of initial squadron, November 1997. Final eight delivered late October 1998, at which time second squadron declared operational. Versions are 2000-5Ei (48 aircraft; single-seat) and 2000-5Di (12 aircraft; two-seat). Requirement revealed in 1997 for an additional 60. Armament includes MICA and Magic AAMs.

Additionally, Jordan ordered 10 2000EJs and two 2000DJs on 22 April 1988; all were cancelled in August 1991.

Total 601 firm orders (excluding seven prototypes and six company-owned trials and demonstrator aircraft) by 1 January 2001 (315 French; 286 exports); none further by 2006. France had received all 124 Cs, 30 Bs, and 75 Ns by 31 December 1995, only 2000Ds being delivered after that date (all 86 by December 2001). Provisional agreement signed with Pakistan in January 1992 for 44 Mirage 2000Es; under further discussion in 1994-95, quantity having been revised to 36, including nine two-seat aircraft, all to 2000-5 standard. No further progress made.

Demonstration and evaluation sorties by a Mirage 2000-5 two-seat version given to Czech, Hungarian and Polish air forces in August 1996. Possible Polish final assembly by PZL Mielec is covered by an MoU announced in June 1997. MoU for assembly by Embraer was agreed before postponement of Brazilian requirement, acquisition of ex-French aircraft having been adopted as 2005 second option.

MIRAGE 2000 ORDERS			
Customer	Qty	Version	First aircraft
Abu Dhabi/UAE ¹	6	2000DAD	701
	8	2000RAD	711
	22	2000EAD	731
	20	2000-9RAD	719 ⁴
	12	2000-9DAD	707 ⁵
Egypt	16	2000EM	101
	4	2000BM	201
France	30	2000B	501
	124 ²	2000C	1
	86	2000D	601
	75	2000N	301
Greece	36 ³	2000EG	210
	4	2000BG	201
	10	2000-5 Mk 2	546
	5	'2000-5B Mk 2'	505
India	46	2000H	KF101
	13	2000TH	KF201
Peru	10	2000P	050
	2	2000DP	193
Qatar	9	2000-SEDA	QA90
	3	2000-5DDA	QA86
Taiwan	48	2000-5Ei	2001
	12	2000-5Di	2051
Subtotal	601		
Prototypes	7		
Development	6		
Total	614		

¹ Total 30 upgraded to 2000-9DAD/RAD. All rebuilt EADs have reconnaissance pod capability and thus become RADs
² 37 upgraded to 2000-5F
³ 10 to be upgraded to 2000-5 Mk 2
⁴ 719 to 731 and 753 to 760
⁵ 707 to 710 and 761 to 768

COSTS: Programme unit cost: Taiwan FFr 333 million (1997).
DESIGN FEATURES: Multirole combat aircraft; low-set, thin delta wing for high internal volume and low wave drag, but with delta's disadvantages in manoeuvrability and landing/take-off requirements offset by relaxed stability and leading-edge slats. Area-ruled fuselage. Wing has cambered section, 58° leading-edge sweep and moderately blended root employing Karman fairings. Cleared for 9 g and 270°/s (automatically limited by FBW system) roll at sub- and supersonic speed carrying six air-to-air missiles.
FLYING CONTROLS: Full fly-by-wire control with Thales four-channel autopilot; two-section elevons on wing move up 16° and down 25°; inner leading-edge slat sections droop up to 17° 30' and outer sections up to 30°; fixed strakes on intake ducts create vortices at high angles of attack that help to correct yaw excursions; small airbrakes above and below wings.
STRUCTURE: Multispar metal wing; elevons have carbon fibre skins with AG5 light alloy honeycomb cores; carbon fibre/light alloy honeycomb panel covers avionics bay; most of fin and all rudder skinned with boron/epoxy/carbon; rudder has light alloy honeycomb core.
LANDING GEAR: Retractable tricycle type by Messier-Bugatti, with twin nosewheels; single wheel on each main unit. Hydraulic retraction, nosewheels rearward, main units inward. Oleo-pneumatic shock-absorbers. Electro-hydraulic nosewheel steering (±45°). Manual disconnect permits nosewheel unit to castor through 360° for ground towing. Light alloy wheels and tubeless tyres, size 360x135-6 or 360x135R6, pressure 9.5 bar (138 lb/sq in) on

nosewheels; size 750x230R15, pressure 15.00 bar (217 lb/sq in) on mainwheels. Messier-Bugatti hydraulically actuated polycrystalline graphite disc brakes on mainwheels, with anti-skid units. Compartment in lower rear fuselage for brake parachute, arrestor hook or additional chaff/flare dispenser.

POWER PLANT: One SNECMA M53-P2 turbofan, rated at 64.3 kN (14,462 lb st) dry and 95.1 kN (21,385 lb st) with afterburning. Alternative M53-P20, rated at 98.1 kN (22,046 lb st), is no longer offered. Movable half-cone centrebody in each air intake.

Internal wing fuel tank capacity 1,325 litres (350 US gallons; 291 Imp gallons); fuselage tank capacity 2,675 litres (707 US gallons; 588 Imp gallons) in single-seat aircraft, 2,595 litres (686 US gallons; 571 Imp gallons) in two-seat aircraft. Total internal fuel capacity 4,000 litres (1,057 US gallons; 880 Imp gallons) in 2000C and E, 3,920 litres (1,036 US gallons; 862 Imp gallons) in 2000B, N, D and S. Provision for one jettisonable 1,300 litre (343 US gallon; 286 Imp gallon) RPL-522 96 kg (212 lb) fuel tank under centre of fuselage, and a 1,700 litre (449 US gallon; 374 Imp gallon) RPL-501/502 210 kg (463 lb) or 2,000 litre (528 US gallon; 440 Imp gallon) drop tank under each wing. Total internal/external fuel capacity 8,526 litres (2,252 US gallons; 1,876 Imp gallons) in 2000C and E, 8,450 litres (2,233 US gallons; 1,859 Imp gallons) in 2000B.

Detachable flight refuelling probe forward of cockpit on starboard side, including export aircraft. Dassault type 541/542 tanks of 2,000 litres (528 US gallons; 440 Imp gallons) are available for the 2000-5, 2000-9, 2000N, D and S wing attachments (and optional on 2000B/C), empty weight 240 kg (529 lb) each, and may be complemented by an RPL-522 on centreline.

ACCOMMODATION: One or two occupants (see Current Versions) on SEMMB licence-built Martin-Baker Mk 10Q zero/zero ejection seat(s), in air conditioned and pressurised cockpit. Pilot-initiated automatic ejection in two-seat aircraft; 500 milliseconds delay between departures. Canopy/ies hinged at rear to open upward and, on Mirage 2000D, covered in gold film to reduce radar signature.

SYSTEMS: ABG-Semca air conditioning and pressurisation system. Two independent hydraulic systems, pressure 280 bar (4,000 lb/sq in) each, to actuate flying control servo units, landing gear and brakes. Hydraulic flow rate 110 litres (29.1 US gallons; 24.2 Imp gallons)/min. Electrical system includes two Auxilec 20110 air-cooled 20 kVA 400 Hz constant frequency alternators (25 kVA in Mirage 2000D and 2000-5), two Bronzavia DC transformers, a SAFT 40 Ah battery and ATEI static inverter. Intertechnique oxygen system.

AVONICS: Comms: Thales ERA-7000 V/UHF com transceiver, ERA-7200 UHF (with optional Have Quick II) or SCP 5000 secure voice com; Thales NRAI-7A/NRAI-11 IFF transponder/interrogator (SC10/IDEE 1 on 2000-5) for Taiwan; SC10/TSA2535 on 2000-9; TSC2031/TSA2531 on 2000-5 Mk 2).

Radar: Thales RDM multimode radar or RDI pulse Doppler radar, each with operating range of 54 n miles (100 km; 62 miles). (Mirage 2000N/D have Thales Antilope terrain-following radar for automatic flight down to 61 m (200 ft) at speeds not exceeding 600 kt (1,112 km/h; 691 mph); Antilope 5TC in 2000N includes altitude-contrast updating of navigation system; Antilope 5-3C in 2000D has full terrain-reference navigation facility.) Thales RDY multimode, multitarget radar in 2000-5 and 2000-9 have the ability to detect 24 targets while tracking eight.

Flight: SOCRAT 8900 solid-state VOR/ILS and IO-300-A marker beacon receiver, Thales radio altimeter (AHV-6 in 2000B and C, AHV-9 in 2000-5/5 Mk 2/9 export aircraft, two AHV-12 in 2000N. Thales NC12 or Deltac Tacan. SAGEM Uliss 52 inertial platform (52D in 2000C and B; 52E for export; and two 52P in 2000N/D; plus integrated GPS in 2000D and 2000-5). Thales Totem 3000 RLG in 2000-9 and 2000-5 Mk 2, combined with GPS and modular data processing. Thales Type 2084 central digital computer and Digibus digital databus (2084-XR in 2000D; Xi in 2000-5. Thales AP 605 autopilot (606 in 2000N, 607 in 2000D, 608 in 2000-5), 609 in 2000-5 Mk 2 and 2000-9). New-generation modular data processing unit in 2000-5 Mk 2 and 2000-9 for mission computing and graphics generation. Thales TLS 2020 MMR (multimode receiver) in 2000-5 Mk 2 and 2000-9, combining ILS, microwave landing and differential GPS). Undisclosed operator ordered BASE (BAE Systems) Terprom GPWS in 1996 for retrofit by Orbital Sciences Corporation. Digital terrain system (DTS) on 2000-9.

Instrumentation: Thales TMV 980 data display system (VE 130 head-up and VMC 180 head-down) (two ICC 55 head-down in 2000N/D). Mirage 2000-5 has Thales integrated multidisplay system featuring combined HUD/head-level display with Thales recording camera. Provision optional in 2000-5 and -9 for Thales Topsight E helmet-mounted sight/display system.

Mission: Mirage 2000-5 has LAM (liaison avion-missile) 'bullet' antenna on fin leading-edge for mid-course guidance of MICA AAMs. Sensors of strike/attack and export versions include 570 kg (1,257 lb) Thales Raphaël SLAR 2000 pod, 400 kg (882 lb) Thales COR2 multicamera pod or 680 kg (1,499 lb) Dassault AA-3-38 Harold long-range oblique photographic (Lorop) pod; 110 kg (243 lb) Thales/Intertechnique Rubis FLIR pod; Thales Atlas laser designator and marked target seeker (in pod on forward starboard underfuselage station); 340 kg (750 lb) Thales PDLCT day/night (TV/thermal imaging) laser designator pod on Mirage 2000D (or CLDP/Atlas II on export aircraft/2000D squadrons also being issued with Atlas II designation pods — being refurbished Atlas systems from Jaguar force), while PDLCT-S available from mid-1999; one 550 kg (1,213 lb) Thales TMV 004 (CT51J) Caiman offensive or intelligence ECM pod and one 400 kg (882 lb) Thales Astac elint (interferometer) pod. Export PDLCT-S known as Damoclès (and Shehab in UAE). Mirage 2000-5 Mk 2 and 2000-9 have Thales Thomrad 5000/6000 secure communications and datalink.

Self-defence: Systems in 2000C and 2000N include Thales Serval radar warning receiver (antennas at each wingtip and on trailing-edge of fin, near tip, plus VCM-65 cockpit display); Thales Caméléon (2000N), Caméléon C2 (2000D) or Sabre (2000C) jammer at base of fin (detector on fin leading-edge); and MBDA Spirale, comprising chaff dispensers in Karman fairings at wing trailing-edge/fuselage intersection and flares in lower rear fuselage. French Air Force DDM (*Détecteur Départ Missile*) missile plume detector requirement satisfied by 1994 purchase of SAGEM SAMIR system for 1995 fitment in rear of Magic launch rails (2000D/N first, but also to 2000Cs patrolling Bosnia). Spirale fitted to 2000N-K2; retrofitted to 2000N-K1 and installed on 2000Cs from No. 93; earlier 2000Cs have Eclair system (Alkan LL5062 chaff and flare launcher) in place of braking parachute, lacking automatic operation. Spirale on some export 2000Es.

Upgrade planned of 2000E with ICMS Mk 1 (integrated countermeasures system; as in 2000EG) comprising RWR and SHR. Thales high-band jammer (leading-edge of fin and bullet fairing at base of rudder) and Spirale; automated ICMS Mk 2 of Mirage 2000-5 adds receiver/processor in nose to detect missile command links; extra pair of antennas near top of fin and additional DF antennas scabbled to existing wingtip pods (fin and secondary wingtip antennas also on Greek Mirage 2000s); ABD2000 export version of Sabre in some Mirage 2000Es. Mirage 2000-5 Mk 2 has ICMS Mk 3. ICMS Mk 3/IMEWS eventually to comprise fully integrated suite of RWR, jammer, Spirale (chaff/flare), additional Eclair (chaff/flare), ESM, tactical situation awareness and targeting. External equipment can include two 182 kg (401 lb) Thales DB 3141/3163 Remora self-defence ECM pods.

EQUIPMENT: Optional 250 kg (551 lb) Intertechnique 231-300 buddy-type in-flight refuelling pod.

ARMAMENT: Two 30 mm DEFA 554 guns in 2000C, 2000E and single-seat 2000-5 (not fitted in B, D or N), with 125 rds/gun. Nine attachments for external stores, five under fuselage and two under each wing. On 2000-5, fuselage centreline stressed for 1,400 kg (3,086 lb) loads; other four fuselage points for 450 kg (992 lb) each; inner wing pylons for 1,830 kg (4,034 lb) each; and outboard wing points for 230 kg (507 lb) each.

Typical interception weapons comprise two 275 kg (606 lb) Super 530D or (if RDM radar not modified with target illuminator) 250 kg (551 lb) 530F missiles (inboard) and two 90 kg (198 lb) 550 Magic or Magic 2 missiles (outboard) under wings. Alternatively, each of four underwing hardpoints can carry a Magic, MICA (active radar or — qualified 31 July 2002 — IR versions) AAM (110 kg; 243 lb) on Mirage 2000-5 Mk 2 and 2000-9. Primary weapon for 2000N is 900 kg (1,984 lb) ASMP tactical nuclear missile mounted on LM-770 centreline pylon.

In air-to-surface role, the Mirage 2000 can carry up to 6,200 kg (13,669 lb) of external stores, including MBDA 250 kg retarded bombs or 32.5 kg (72 lb) TDA BAP 100 anti-runway bombs; 16 MBDA Durandal 219 kg (483 lb) penetration bombs; one or two 990 kg (2,183 lb) MBDA BGL 1000 laser-guided bombs; five or six 305 kg (672 lb) MBDA Belouga cluster bombs or 400 kg (882 lb) TDA BM 400 modular bombs; up to three Rafaut F2 practice bomb launchers; US Mk 20, Mk 82, GBU-24 and GBU-12 bombs; two 520 kg (1,146 lb) AS 30L, Armat anti-radar, or 655 kg (1,444 lb) AM 39 Exocet anti-ship, air-to-surface missiles; four 185 kg (408 lb) MBDA LR F4 rocket launchers, each with eighteen 68 mm rockets; two packs of 100 mm rockets; or a 765 kg (1,687 lb) Dassault CC 630 gun pod, containing two 30 mm guns and total 600 rounds of ammunition.

Mirage 2000D armed with APACHE-AP and SCALP-EG, plus GBU-12, GBU-16 and GBU-24 versions of Paveway LGB. Stealthy cruise missiles. For air defence weapon training, a Cubic Corporation AIS (airborne instrumentation subsystem) pod, externally resembling a Magic missile, can replace Magic on launch rail, enabling pilot to simulate a firing without carrying actual missile.

DIMENSIONS, EXTERNAL:

Wing span	9.13 m (29 ft 11½ in)
Wing aspect ratio	2.0
Length overall: 2000C, E	14.36 m (47 ft 1¼ in)
—S	14.33 m (47 ft 0¼ in) ¹
2000B, N	14.55 m (47 ft 9 in) ¹
Height overall: 2000C, E, —S	5.14 m (16 ft 10¼ in)
2000B, N, D	5.10 m (16 ft 8¾ in)
Wheel track	3.50 m (11 ft 5¾ in)
Wheelbase	5.00 m (16 ft 4¾ in)

¹ 2000D, —S, —S Mk 2 and —9 versions lack nose pitot

AREAS:

Wings, gross	41.0 m ² (441.3 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty: 2000C, E, —S	7,500 kg (16,534 lb)
2000B, N, D	7,600 kg (16,755 lb)
2000-5 Mk 2; single-seat	7,920 kg (17,460 lb)
two-seat	7,990 kg (17,615 lb)
Max internal fuel: 2000C, —S	3,160 kg (6,967 lb)
2000B, N, D	3,100 kg (6,834 lb)
Max external fuel	4,140 kg (9,127 lb)
Max external stores load	6,200 kg (13,669 lb)
Combat weight: 2000-5	9,500 kg (20,944 lb)
T-O weight clean: 2000C, E, —S	10,860 kg (23,940 lb)
2000B, N, D	10,960 kg (24,165 lb)
Max T-O weight: except —S, —9:	
normal	14,000 kg (30,864 lb)
overload	17,000 kg (37,480 lb)
—S, —9	17,500 kg (38,580 lb)
Max landing weight	16,700 kg (36,817 lb)
Max wing loading	414.6 kg/m ² (84.92 lb/sq ft)
Max power loading (M53-P2)	179 kg/kN (1.75 lb/lb st)

PERFORMANCE (M53-P2 power plant):

Max level speed: at height	M2.2
at S/L	M1.2
Max continuous speed: 2000C, E	M2.2
2000N, D	M1.6
Min speed in stable flight	100 kt (185 km/h; 115 mph)
Authorised min flight speed	zero
Approach speed	140 kt (259 km/h; 161 mph)
Landing speed	125 kt (232 km/h; 144 mph)
Max rate of climb at S/L:	
M53-P2	17,060 m (56,000 ft)/min
M53-P20	16,765 m (55,000 ft)/min
Time to 11,000 m (36,080 ft) and M1.8:	
2000-5	approx 5 min
Time from brake release to intercept target flying at M3.0 at 24,400 m (80,000 ft)	less than 5 min
Service ceiling: 2000C	16,460 m (54,000 ft)
2000-5	18,290 m (60,000 ft)

Range: hi-hi-hi	1,000 n miles (1,852 km; 1,151 miles)
interdiction, hi-lo-hi	800 n miles (1,480 km; 920 miles)
attack, hi-lo-hi	650 n miles (1,205 km; 748 miles)
attack, lo-lo-lo	500 n miles (925 km; 575 miles)
with one 1,300 litre and two 1,700 litre drop tanks	1,800 n miles (3,333 km; 2,071 miles)
Operational loiter (2000-5) at M0.8 at 7,620 m (25,000 ft) with three external tanks, four MICA and two Magic AAMs	2 h 30 min
Operational range (2000-5) for 5 min combat at M0.8 at 9,145 m (30,000 ft) with four MICA and two Magic AAMs, tanks jettisoned	780 n miles (1,445 km; 898 miles)
g limits:	+9.0/−3.2 normal
	+11.0/−4.5 ultimate

DASSAULT RAFALE

English name: Squall

TYPE: Multirole fighter.

PROGRAMME:

DEVELOPMENT MILESTONES

Design began	June 82
Official go-ahead	late 82
First order (demonstrator)	13 Apr 83
Rolled out	14 Dec 85
First flight	4 July 86
First flight, pre-production	19 May 91
Production go-ahead	23 Dec 92
First flight, production	24 Nov 98
First delivery (Landivisiau)	Dec 00
Entered service (12 F)	18 May 01

Ordered (as *Avion de Combat Tactique*; ACT) to replace French Air Force Jaguars and (as *Avion de Combat Marine*; ACM) Navy Crusaders and Super Etendards; first flight of Rafale A prototype (F-ZJRE) 4 July 1986; first flight with SNECMA M88 replacing one GE F404, 27 February 1990 (was 461st flight overall); 867th and final sortie, 24 January 1994. ACE International (*Avion de Combat Européen*) GIE set up in 1987 by Dassault Aviation, SNECMA, Thomson-CSF (now Thales) and Dassault Electronique, partly to attract international partners; none found. Four preproduction aircraft, as described under Current Versions (specific). Production launch officially authorised, 23 December 1992 (and 31 December 1992 for M88-2 power plant). First Rafale B and Rafale M ordered 26 March 1993; first production aircraft (Rafale B No. 301) flew 24 November 1998 and made 'inaugural' (official) first flight 4 December; to CEV at Istres, early 1999, for development of F2 production standard. First production Rafale M (No. 1) flew at Bordeaux 7 July 1999. Rafale had by then accumulated over 4,000 sorties.

Test airframe, in Rafale M configuration, delivered to CEAT at Toulouse for ground trials 10 December 1991. Between 17 December 1991 and 2 March 1993, completed 10,000 simulated flights, including 3,000 catapult take-offs and 3,000 deck landings. Rafale structural validation achieved 15 December 1993.

French Air Force preference switched to operational two-seat (pilot and WSO) derivative of Rafale C in 1991; announced 1992 that 60 per cent of procurement to be two-seat, although 16 aircraft deleted from requirements at this time. Procurement target further reduced, as detailed in Customers paragraph. Two-seat version of naval Rafale announced September 2000.

Funding constraints and French government demands for cost reductions resulted in suspension of Rafale programme in November 1995 and temporary blocking of most 1996 funds. Plans were simultaneously abandoned for three progressively more sophisticated service standards of Rafale (*Standard Utilisateur* 0, 1 and 2) and replaced by a common French military standard and an export parallel, although three basic software standards (F1 to F3) will phase-in operational capabilities, as described under Current Versions (general). Work on production Rafales temporarily halted in April 1996. On 22 January 1997, Dassault and French defence ministry agreed on 48-aircraft multiyear procurement (1997–2002) in return for a 10 per cent cost reduction, effectively relaunching the programme. This initiative lapsed with the change of government after June 1997, but reinstated in January 1999, with firm orders for 28, plus 20 options, covering deliveries between 2002 and 2007. Contract awarded January 2000 for development of F2 Standard Rafale, representing first capability upgrade, F3 standard authorised 18 February 2004.

First production aircraft completed late 1998; second and third (No. 302 and M1) delivered to CEV trials unit late 1999/early 2000; M2 and M3 to Landivisiau naval air station, December 2000; first naval squadron, 12 F, formed 18 May 2001 and achieved planned strength of 10 Rafales in September 2002; first operational carrier deployment by four aircraft (M2 to M5) aboard FS *Charles de Gaulle* for exercise Trident d'Or in Mediterranean, 21 to 29 May 2001. First three Rafales for French Air Force delivered to conversion squadron EC 5/330 *Côte d'Argent* within CEAM trials establishment at Mont-de-Marsan. No. 304 on 22 December 2004; No. 305 on 28 December; and No. 303 on 29 December. Unit formed basis of EC 1/7 *Provence* at Dijon in mid-2006. First Air Force single-seat aircraft (C102) delivered 3 June 2005.

Associated programmes include Thales electronic scanning RBE2 (*Radar à Bayalage Electronique deux plans*) multimode radar, ordered November 1989; test flights begun in Falcon 20 No. 104, 10 July 1992; first RBE2 flight in Rafale 7 July 1993 (B01); first production RBE2 flew on 16 October 1997 in a Falcon 20 before being refitted in Rafale B01 from November 1997. Development authorised in early 1999 of upgraded RBE2 version (full air-to-ground weapons capability) for 2003 delivery and installation in F2 standard Rafales.

Thales/MBDA defensive aids package named Spectra (*Système pour la Protection Electronique Contre Tous les Rayonnements Adverses*); wholly internal IR detection, laser warning, electromagnetic detection, missile approach warning, jamming and chaff/flare launching; nine prototypes ordered; total weight 250 kg (551 lb); Spectra trials begun on Mirage 2000 in 1992, while full suite installed in Falcon 20 No. 252 by Dassault at Istres between December 1992 and September 1994 before flight trials; Spectra flown in Rafale M02 on 20 September 1996 at launch of integration programme at CEV Istres. Development contract awarded 1991 for Thales OSF (*Optronique Secteur Frontal*) with IRST, FLIR and laser range-finder in two modules ahead of windshield; surveillance, tracking and lock-on by port module; target identification, analysis and optical identification by starboard module; combined output in pilot's head-level display; initially tested in Mirage 2000BOB. In December 2004, it was acknowledged that early Rafales would lack Spectra and OSF (48 sets of latter ordered by that time) pending definition of new-generation systems, revised OSF delivery target being 2011-12.

M88 engine, which has flown only on Rafales, achieved type certification on 22 March 1996. First of initial production batch of 42 M88-2 engines delivered by SNECMA



Initial Rafale B for French Air Force on its delivery flight, 22 December 2004 (SIRPA Air)

1153762

30 December 1996. Conformal fuel tanks flight-tested in April 2001. Integration of Matra BAe MICA AAM completed 5 July 2000, after 27 launches.

Rafale offered for export; Greek evaluation in January 2000; model displayed February 2000 carried two conformal fuel tanks, each of 1,250 litres (330 US gallons; 275 Imp gallons), increasing range with two SCALP missiles to 1,000 n miles (1,852 km; 1,150 miles), hi-lo-hi. Rafale B No. 302 equipped with supplementary software to enable demonstration of LGB capability; test separation of GBU-12 bombs in April 2000, followed by live drop in October 2000. Offered in South Korea's F-X competition (40 aircraft), but unsuccessful against Boeing F-15K, early 2002.

CURRENT VERSIONS (GENERAL): Rafale B: Originally planned two-seat, dual-control version for French Air Force; weight initially envisaged as 350 kg (772 lb) more than Rafale C; 3 to 5 per cent higher cost than Rafale C. Being developed into fully operational variant for either pilot/WSO or single-pilot combat capability. Serial numbers begin at 301. First two assigned to Dassault at Istres by 2004, both in F2 avionics configuration.

Rafale C: Single-seat combat version for French Air Force. Serial numbers begin at 101, first flown 16 April 2003. First aircraft to F2 standard with Dassault test fleet at Istres, 2004.

Rafale D: Original configuration from which production versions derived; now 'Rafale Discret' (stealthy) generic name for French Air Force versions.

Rafale M: Single-seat carrierborne fighter; serial numbers begin at 1. Navalisation weight penalty, 610 kg (1,345 lb); has 80 per cent structural and equipment commonality with Rafale C, 95 per cent systems commonality. Navy's financial share of French programme cut in 1991 from 25 to 20 per cent.

Initial operational software standard for Rafale M, designated F1, permits air defence missions against multiple targets using Magic and radar-homing version of MICA; self-defence provided by Spectra system. F2 will apply to both naval and air force Rafales delivered from late 2004 (15 M/Ns, 22 Bs and 11 Cs) and combine F1 with air-to-ground radar modes and the ability to launch IR-guided MICA, SCALP and AASM weapons as well as OSF electro-optics suite and MIDS datalink; operational in 2006. Funding for F2 development granted 31 December 1998; first stage of F2, known as E12, is OSF, SCALP and standard air-to-surface ordnance. First production aircraft, M1, on loan to Dassault for F2 integration, including weapons carriage, and will be upgraded to F3. Last of 25 single-seat naval Rafales to be delivered in 2008. In same year (operational 2009), F3 standard (for which initial, risk mitigation phase launched January 2003 and full go-ahead given 18 February 2004) provides full capabilities to naval and air force Rafales, including air-to-sea attack, AM39 and ASMP-A weapons, refuelling and reconnaissance pods, and helmet-mounted display. Anticipated engine upgrade to 88.3 kN (19,840 lb st) was not included in F3. Unspecified and unfunded F4 envisaged for 2010, but early naval aircraft will all have been upgraded to F2 and F3 by 2008; Meteor AAM and associated electronically scanned radar antenna are key elements of F4.

Rafale N: Cancelled in September 2004. Was to have been two-seat, dual control, naval version; also known briefly as Rafale BM; announced September 2000; development and production contracts placed December 2002; prototype, No. 16, for trials in 2006; requirement for 35 aircraft within overall Navy purchase; first production aircraft in 2008; final delivery in 2012. Cost 5 per cent more than single-seat M; 250 kg (551 lb) heavier, but 215 kg (474 lb) less internal fuel; 85 per cent commonality with three previous versions; deletion of internal canon replaces 200 litres (52.8 US gallons; 44.0 Imp gallons) of fuel lost with addition of second seat.

'Rafale Mk 2': Export version, under active consideration by 2000, featuring active antenna radar, M88-3 engines of 88.3 kN (19,850 lb st) each. Available from 2006; conformal tanks and Damoclès laser target designator. Development cost estimated in 2001 as €1.3 billion; joint venture agreed in January 2001 by Dassault, Thales and SNECMA; offered to South Korea.

CURRENT VERSIONS (SPECIFIC): C01: Single-seat Rafale C prototype, C01/F-ZWVR, ordered 21 April 1988; flown 19 May 1991; officially flight tested at CEV in October 1991, two months ahead of schedule; 100th sortie 12 May 1992. First Rafale gun firing, 5 March 1993; first Magic 2 AAM launch, 26 March 1993. Continued high AoA trials in 2000, having exceeded 30°. M88-2 Stage 4 engine trials in late 2000; continued engine trials into 2004. Second Rafale C order (C02) not placed; abandoned 1991.

M01: First navalised prototype, F-ZWVM, ordered 6 December 1988; flown 12 December 1991. Assigned to structural qualification, FCS and aerodynamic trials. Catapult trials ashore at US Naval Air Warfare Center, Patuxent River, and Lakehurst, 13 July/23 August 1992; second series of US trials 15 January/18 February 1993 followed by deck trials on *Foch*; first deck landing 19 April 1993; first deck launch 20 April 1993, although first take-offs with 'jump strut' nosewheel leg began in following month; third US trials series 18 November/16 December 1993, carrying external loads; fourth series, October/December 1995, including dummy deck launch at maximum weight of 22,300 kg

(49,163 lb). On 8 June 1995, M01 made the first launch of a MICA AAM against an aerial target acquired by RBE2 radar fitted in a Rafale. Employed on development trials for F2 production standard. Total 438 hours in 723 sorties by October 1997. In storage 1999; F1 standard avionics trials in 2000. Retired by 2003 and in storage at Istres.

B01: Two-seat dual-control trainer Rafale B prototype, B01/F-ZWVS, ordered 19 July 1989 as first with RBE2 radar and Spectra defensive systems; first flight 30 April 1993; first flight with RBE2 7 July 1993. Longest Rafale sortie, Istres to Dubai, November 1995: approximately 3,020 n miles (5,600 km; 3,475 miles) in 6 hours 30 minutes with three aerial refuellings (including one precautionary). Heavy configuration trials (23,400 kg; 51,588 lb, including two APACHES) completed in February 1997. Total 990 sorties by mid-1999. First Rafale to fly with conformal tanks, 18 April 2001. APACHE/SCALP trials continuing in 2004.

M02: Second naval prototype, ordered 4 July 1990; first flight 8 November 1993; assigned to operational and maintenance testing aboard ship and navigation/weapons trials. Joint carrier trials with M01 aboard *Foch* (second series) 27 January/4 February 1994. Third series of deck trials (M02 only) aboard *Foch* begun 17 October 1994 for three weeks (total 28 launches including two at night); included maintenance, electromagnetic compatibility, RBE2 radar and Spectra ECM tests. Fitted with model of OSF in late 1994, for vibration tests. Flew Singapore to Istres (6,300 n miles; 11,668 km; 7,250 miles) in under 15 hours, February 1996. First launch of Magic 2 AAM at moving target, 4 April 1996. Total 297 hours in 348 sorties by October 1997. With B01, employed by 1998 on development of F2 and F3 avionics standards. On 6 July 1999 became only second jet fighter (following Super Etendard) to land on new carrier FS *Charles de Gaulle*. Continued Spectra trials in 2000. Dassault trails fleet at Istres in F2 configuration, 2004.

CUSTOMERS: Anticipated worldwide market for 500 aircraft in addition to originally planned 250 for French Air Force (225 Cs and 25 Bs) and 86 for French Navy; former service announced revised requirement for 234, comprising 95 Rafale Cs and 139 two-seat (pilot and WSO) combat versions, in 1992. Defence economies in 1996 included reduction of requirements to 60 Ms and Ns.

Naval deliveries began with No. 2 to CEPA trials unit on 19 July 2000, followed by No.3 in September 2000; service familiarisation began 4 December 2000 when Nos. 2 and 3 delivered to Landivisiau naval air base; Landivisiau's 12 Flottille re-formed 18 May 2001 with four aircraft; first operational voyage began aboard *Charles de Gaulle* (commissioned 1999) on 1 December 2001, and Nos. 2 to 8 had embarked by 10 March 2002, when stationed in Arabian Gulf; Nos. 9 and 10 received mid-2002 and IOC then declared in October 2002. Full capability achieved 24 June 2004 with formal acceptance into naval service.

Balance of naval order replaces Super Etendards, 11 Flottille being first recipient, in 2006-07; third squadron to follow. Navy received 10 aircraft in F1 configuration (actually LF1, which upgraded to partial F1 in early 2002, incorporating some air-to-air capability, although full F1, with cannon and MICA AAM, not due until late 2002) 15 F2s and 35 F3s, last in 2015, all to be based at Landivisiau. Actual or planned deliveries (at mid-2004) were one, three, five and one in 1999-2002, followed by six, 10, three and four in 2006-2009, then 27 up to 2015.

Air Force deliveries originally planned for 1996-2009, including first 20 in interim configuration; two year postponement announced 1992; further slips in development funding delayed first receipts to 2002 and IOC to 2006. Only Air Force's first three aircraft 301, 302 and 101 (two Bs and one C) to F1 standard. Deliveries of F2.1 standard aircraft began to CEAM operational trials unit at Mont-de-Marsan in December 2004; first squadron, EC 1/7 'Provence', established within CEAM on 1 July 2005, prior to gaining autonomy at St Dizier with 15 Rafale Bs (upgraded to F2.2) one year later.

Official authorisation to launch production given 23 December 1992. Initial production contract in 1993 defence budget (formally awarded 26 March 1993), comprising one aircraft each for Air Force and Navy. Total 13 by 1996, while 1997-2002 plan envisaged 33 B/Cs and 15 naval versions (total 48) to be ordered (and two Bs and 12 Ms delivered), followed by orders for 15 B/Cs per year from 2003. In early 1997, French defence procurement agency, DGA, agreed with Dassault a multiyear procurement of the 48 aircraft in return for a 10 per cent cost reduction, but this later suspended. Authorisation to order the first 13 Rafales was only granted in May 1997, however. At the same time, separate plans were being formulated for acceleration into service of the first 10 air force Rafales to equip an export-promoting and operational trials (half) squadron, but those plans also soon abandoned. Eventually, go-ahead given on 14 January 1999 for 48 aircraft, including 20 options, these confirmed on 21 December 2001. In 2003, details finalised for further batch of 59 (46 Air Force and 13 Navy), making 120 (82 + 38) in all, this finally approved on 6 December 2004, with deliveries between June 2008 (B328) and January 2012.

Deliveries in 2003-08 five-year plan will be 47 to Air Force and 16 to Navy. Export



Dassault Rafale B No. 302, assigned to F3 standard upgrade development (SIRPA Air)

1153763

versions of naval variant were available to potential customers from 1999 onwards. China expressed interest in 1996–97, French expects 234th aircraft to be delivered in 2023,

RAFALE PLANNED ORDERS AND DELIVERIES				
Date	Orders		Deliveries	
	AF	Navy	AF	Navy
up to 2002	36	25	2	10
2003–2008	94	31	47	16
post 2008	104	4	185	34
Totals	234	60	234	60

RAFALE PROCUREMENT				
Year	Rafale C	Rafale B	Rafale M	Total
1993		1	1	2
1994		1	2	3
1995			5	5
1996		1	2	3
1997				
1998				
1999 ¹	7	14	7	28
2001	5	7	8	20
2002				
2003				
2004	36	11	12	59
Totals	48	35	37	120

¹ start of F2 production version; earlier aircraft are F1; 62nd and subsequent will be F3

Notes: Orders as announced. Third Rafale B was subsequently exchanged with first production Rafale C.

COSTS: Estimated EUR26.4 billion for 234 aircraft (2005). Programme originally estimated at FF155 billion (1991), including FF40 billion for R&D; revised to FF178 billion in 1993, FF198.4 billion in 1995 and FF202.37 billion in 1996. Last mentioned total comprises FF48.62 billion (of which 25 per cent paid by industry) for development, FF17.583 billion for industrialisation, FF76.25 billion for 234 Rafale B/Cs, FF20.89 billion for 60 Rafale Ms, FF37.812 billion for spares and FF1.215 billion for simulators. Early 1997 agreement on 10 per cent cost reduction resulted in flyaway price falling to FF282 million for a Rafale C, FF299 million for Rafale B and FF315 million for Rafale M. Total of FF30 billion spent by 1995. Second production order for eight aircraft (1994/1995 authorisations) estimated at FF1.5 billion, excluding engines, radar and weapons system. In 1998, however, new cost estimate for 294 aircraft was FF320 billion as a consequence of programme delays, this having become €33,274 million by 2004. Cost (1999) of 48 aircraft

given as FF17.2 billion. Introduction of Rafale N version increased programme cost by €274 million. F3 upgrade (2004) valued at €659 million.

DESIGN FEATURES: Multirole combat aircraft, rivaling Eurofighter Typhoon; designated "omnirole" to describe simultaneous air-to-air and air-to-ground capabilities. Minimum weight and volume structure to hold costs to minimum; thin, mid-mounted delta wing with moving canard; individual fixed, kidney-shaped intakes without shock cones, HOTAS controls, with sidestick controller on starboard console and small-travel throttle lever.

All components of modular design (including engine), replaceable at base engineering level; Rafale does not need ever to leave its operational station for maintenance.

Wing leading edge sweepback approximately 48°.

FLYING CONTROLS: Fully digital fly-by-wire controls with fully modulated two-section leading edge slats and two elevons per wing; canard incidence automatically increased to 20° when landing gear lowered. Specification includes 30° AoA in stable flight.

STRUCTURE: Most of wing components made of carbon fibre including elevons; slats in titanium; wingroot and tip fairings Kevlar; canard made mainly by superplastic forming and diffusion bonding of titanium; fuselage 50 per cent carbon fibre; fuselage side skins of aluminium-lithium alloy; wheel and engine doors carbon fibre; fin made primarily of carbon fibre with aluminium honeycomb core in rudder. Composites account for 25 per cent by weight of structure and 20 per cent of surface area; weight saving directly attributable to composites is 300 kg (661 lb) — equivalent to a 1 tonne reduction in empty weight.

LANDING GEAR: Hydraulically retractable tricycle type supplied by Messier-Dowty, with single 790x275-15 (20 ply) or 790x275R15 mainwheels and twin, hydraulically steerable, 360x135-6 or 360x135R6 nosewheels. All wheels retract forward. Designed for impact at vertical speed of 3 m (10 ft)/s, or 6.5 m (21 ft)/s in naval version, without flare-out. Rafale M has same mainwheels; but 520x140R10.5 nosewheels, Messier-Bugatti carbon brakes on all three units, controlled by fly-by-wire system.

Rafale M has 'jump strut' nosewheel leg which releases energy stored in shock-absorber at end of deck take-off run, changing aircraft's attitude for climb-out without need for ski-jump ramp. 'Jump strut' advantage equivalent to 9 kt (16 km/h; 10 mph) or 900 kg (1,984 lb) extra weapon load; not to be used aboard aircraft carrier *Foch*, which to have 1° 30' ramp giving 20 kt (37 km/h; 23 mph) or 2,000 kg (4,409 lb) advantage. Dowty Aerospace Yakima holdback fitting. Naval nosewheel steerable ±70°, or almost 360° under tow. Hydraulic (Rafale M) or tension stored (Rafale B/C) arrestor hook. Landing gear management (braking and steering) by Thales computer.

POWER PLANT: Two SNECMA M88-2E4 augmented turbofans, each rated at 48.7 kN (10,950 lb st) dry and 72.9 kN (16,400 lb st) with afterburning. Stage 1 standard engines in first 13 (F1) production Rafales were limited to 300 hour hot-section TBO; Stage 4, flight tested from late 2000 and certified in December 2001, achieves initial 600 hours and intended for eventual 1,000 hours, had been retrofitted in all aircraft by late 2000. M88-3 of 88.3 kN (19,840 lb st) maximum rating offered as follow-on, and being developed for export Rafale.

Internal tanks in single-seat versions for approximately 5,900 litres (1,559 US gallons; 1,298 Imp gallons) of fuel. Rafale B internal fuel confirmed as 5,300 litres (1,400 US gallons; 1,166 Imp gallons). Fuel system by Lucas Air Equipement, Lebozec and Zenith



French Air Force Dassault Rafale B No. 305 in service with CEAM (Jean-Louis Gaynecoetche)

1153760



Dassault Rafale C (François Robineau) 1153761

Aviation; equipment by Intertechnique. Five 'wet' hardpoints: centreline, two inboard wing and two centre wing; all able to accommodate a 1,250 litre (330 US gallon; 275 Imp gallon) external tank; alternative 2,000 litre (528 US gallon; 440 Imp gallon) centreline and inboard; alternative conformal tanks on spine, length 7.50 m (24 ft 7¼ in); total capacity 2,300 litres (608 US gallons; 506 Imp gallons), and able to accept in-flight replenishment. Pressure refuelling in 7 minutes, or 4 minutes for internal tanks only. Fixed (detachable) in-flight refuelling probe on all versions.

ACCOMMODATION: Pilot only, on SEMMB (Martin-Baker) Mk 16 zero/zero ejection seat, reclined at angle of 29°. One-piece Sully Produits Spéciaux blister windscreen/canopy, hinged to open sideways to starboard. Canopy gold-coated to reduce radar reflection.

SYSTEMS: Technofan cockpit air conditioning system; Cryotechnologies avionics cooling system. Dual hydraulic circuits, pressure 350 bar (5,075 lb/sq in), each with two Messier-Bugatti pumps and Bronzavia ancillaries. Auxilec electrical system, with two 30/40 kVA Auxilec variable frequency alternators. Triplex digital plus one dual analogue fly-by-wire flight control system, integrated with engine controls and linked with weapons system. Air Liquide OBOGS; EROS oxygen system; L'Hotellier fire detection system; Microturbo APU below fin fillet.

AVIONICS: Provision for more than 780 kg (1,720 lb) of avionics equipment and racks.

Comms: Thales V/UHF and Thales TRA 6032 SATURN UHF radios; Thales SB25A transponder/interrogator. TEAM intercom; Thales voice-activated radio controls and voice alarm warning system. Chelton aericals.

Radar: GIE Radar (Thales) RBE2 look-down/shoot-down radar, able to track up to eight targets simultaneously, with automatic threat assessment and allocation of priority. RBE2 AA (active array) version offered for export Rafales from 2006. Radar access via port-hinged radome.

Flight: Thales TLS-2020 integrated ILS/MLS, VOR/DME; SAGEM Sigma 95N (RL-90) RLG INS (SAGEM Telemir interface with carrier's navigation on Rafale M); Thales AHV-17 radio altimeter and SFIM/Thales ESPAR static memory flight recorder.

Instrumentation: Digital display of fuel, engine, hydraulic, electrical, oxygen and other systems information on two 127 × 127 mm (5 × 5 in) lateral multifunction touch-sensitive colour LCD displays by Thales. Third cockpit screen is 20 × 20° head-level tactical navigation/sensor display. Thales CTH3022 wide-angle, holographic HUD (30 × 22° field of view) incorporating Signaal USFA OTA-1320 CCD camera and recorder. Both displays collimated at infinity. Thales/Intertechnique Topsight E helmet-mounted sight.

Mission: Thales OSF electro-optical sensors and SAGEM OSF infra-red sensors to be introduced by 2011-12. MIDS (Multifunctional Information Distribution System) datalink (equivalent to JTIDS/Link 16). Various reconnaissance, ECM, FLIR and laser designation pods, including Thales Damoclès target designator and projected Thales RECO-NG pod. Terrain-following system initially cleared (1999) to 152 m (500 ft); over land, reduced to 91 m (300 ft) by 2002, plus 30 m (100 ft) over sea; eventual goal is 30 m (100 ft) land and 15 m (50 ft) over water.

Self-defence: Spectra radar warning and ECM suite by Thales and MBDA. Thales DAL (Défenseur d'Alerte Laser) system. Flare launchers in rear wing/fuselage fairing.

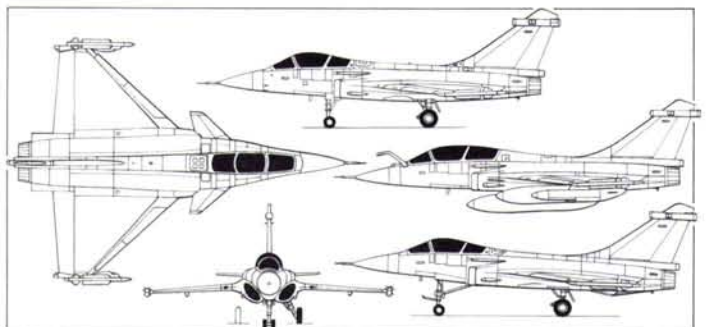
EQUIPMENT: Integral, electrically operated, folding ladder in Rafale M.

ARMAMENT: One 30 mm Giat DEFA 791B cannon in side of starboard engine duct (except naval two-seat). Fourteen external stores attachments: two on fuselage centreline, two beneath engine intakes, two astride rear fuselage, six under wings and two at wingtips; of these, five stressed for heavy stores and fuel tanks. Forward centreline position deleted on Rafale M. Normal external load 6,000 kg (13,228 lb); maximum permissible, 9,500 kg (20,944 lb); see weapon options table. In strike role, one ASMP standoff nuclear weapon. In interception role, up to eight MICA AAMs (with IR or active homing) and two underwing fuel tanks; or six MICAs and three external fuel tanks. In air-to-ground role, typically sixteen 227 kg (500 lb) bombs, two MICAs and two 1,250 litre (330 US gallon; 275 Imp gallon) tanks; or two APACHE standoff weapon dispensers, two MICAs and three tanks; or FLIR pod, Damoclès laser designator pod, six 250 kg LGBs, four MICAs and single tank. In anti-ship role, two Exocet sea-skimming missiles, four MICAs and two external fuel tanks. Future weapons will include AASM (Armement Air-Sol Modulaire) powered LGB on F3 standard aircraft.

DIMENSIONS, EXTERNAL:

Wing span, incl wingtip missiles 10.80 m (35 ft 5¼ in)

Wing aspect ratio	2.6
Length overall	15.27 m (50 ft 1¼ in)
Height overall (Rafale D)	5.34 m (17 ft 6¼ in)
AREAS:	
Wings, gross	45.70 m² (491.9 sq ft)
WEIGHTS AND LOADINGS (estimated):	
Basic weight empty, equipped:	
Rafale C	9,850 kg (21,716 lb)
Rafale B	10,450 kg (23,038 lb)
Rafale M	10,460 kg (23,060 lb)
Rafale N	10,710 kg (23,611 lb)
External load (incl fuel): normal	6,000 kg (13,228 lb)
max	9,500 kg (20,944 lb)
Max fuel weight: internal:	
single seat	4,700 kg (10,362 lb)
two seat: Rafale B	4,350 kg (9,590 lb)
Rafale N	4,240 kg (9,348 lb)
underwing	7,500 kg (16,535 lb)
conformal	1,850 kg (4,079 lb)
Max T-O weight: Rafale M: initial	14,000 kg (30,864 lb)
subsequent	19,000 kg (41,887 lb)
developed version	24,500 kg (54,013 lb)
Max landing weight	22,500 kg (49,605 lb)
Max wing loading: Rafale M: initial	306.3 kg/m² (62.74 lb/sq ft)
subsequent	415.8 kg/m² (85.15 lb/sq ft)
developed version	536.1 kg/m² (109.80 lb/sq ft)
Max power loading: Rafale M: initial	96 kg/kN (0.94 lb/lb st)
subsequent	130 kg/kN (1.28 lb/lb st)
developed version (M88-3)	141 kg/kN (1.38 lb/lb st)
PERFORMANCE (estimated):	
Max level speed: at altitude	M1.8
at low level	750 kt (1,390 km/h; 864 mph)
Approach speed	120 kt (223 km/h; 139 mph)
Max rate of climb at S/L	approx 18,290 m (60,000 ft)/min
Roll rate	270°/s
Max instantaneous turn rate	up to 30°/s
Service ceiling	16,765 m (55,000 ft)
T-O distance: air defence	400 m (1,315 ft)
attack	600 m (1,970 ft)
Landing distance	450 m (1,480 ft)



Dassault Rafale C, with additional profiles of Rafale B (centre) and Rafale M (bottom) 1154515

Radius of action: low-level penetration with 12 × 250 kg bombs, four MICA AAMs and 4,000 litres (1,056 US gallons; 880 Imp gallons) of external fuel in three tanks 570 n miles (1,055 km; 655 miles)
air-to-air, long-range with eight MICA AAMs and 6,000 litres (1,585 US gallons; 1,320 Imp gallons) of external fuel in four tanks, 12,200 m (40,000 ft) transit 950 n miles (1,759 km; 1,093 miles)
Operational loiter up to 3 h
g limits +9.0/-3.2

DASSAULT FALCON 50

Spanish Air Force designation: T.16

TYPE: Business tri-jet.

PROGRAMME:

DEVELOPMENT MILESTONES

Falcon 50	
First flight	7 Nov 76
First flight, pre-production	13 Jun 78
Certification	27 Feb 79
First delivery	Jul 79
Subsequent versions	
Falcon 50EX	
Announced	26 Apr 95
First flight	10 Apr 96
Certification	15 Nov 96
First delivery	Feb 97

First flight of prototype Falcon 50 (F-WAMD) 7 November 1976; second prototype 18 February 1978; first (and only) preproduction 13 June 1978. French certification 27 February 1979; FAA certification 7 March 1979; deliveries began July 1979. Available in sigint version from 1994.

Falcon 50EX announced 26 April 1995. Long-range variant: uprated turbofans provide a 7 per cent improvement in fuel consumption and improved initial cruising altitude of 12,500 m (41,000 ft). Production of initial batch of 40 Falcon 50EX airframes began 1995. First flight (F-WOND, c/n 251) 10 April 1996; new avionics suite installed in Falcon 50 c/n 252 for integration flight testing leading to avionics certification by FAA on 15 July 1996; DGAC certification achieved 15 November 1996, followed by FAA approval 20 December; initial production aircraft (F-WWHA, c/n 253) first flight October 1996; flown in 'green' condition Le Bourget, Paris, to Teterboro, New Jersey, 16 November, thence to Orlando, Florida, for US debut at National Business Aircraft Association Convention; first customer delivery (to Volkswagen of Germany) February 1997. Total of 93 EXs delivered by December 2005. Estimated market for 150 to 200 of EX version over unspecified period.

CURRENT VERSIONS: **Falcon 50:** Previous version, now superseded by Falcon 50EX.

Falcon 50-40: Retrofit of earlier version with Honeywell TFE731-40 engines, each 16.46 kN (3,700 lb). See *Jane's Aircraft Upgrades*.

Falcon 50EX: As described.

Falcon 50M Surmar: Maritime surveillance version.

First flight (No. 36/F-ZWTA) November 1998; first delivery in January 2000; operational with Flottille 24 at Lann-Bihoué from September 2000. Final (fourth) delivery in early 2002.

Falcon 50 Sigint: Model of a potential signals intelligence Falcon 50 displayed at Dubai Air Show in November 1997.

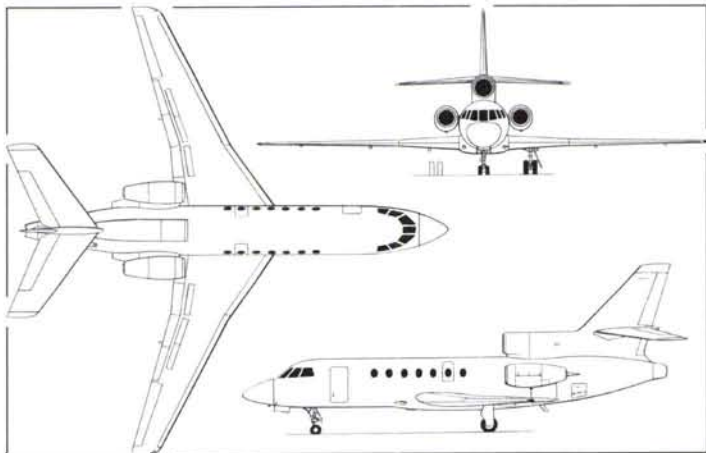
CUSTOMERS: Total 343 Falcon 50s and 50EXs delivered for outfitting by 30 September 2005, including 18 in 2000, 13 (all 50EXs) in 2001, 10 in 2002, eight in 2003, five in 2004 and five in 2005. Adopted by governments of Burundi, Djibouti, France, Iraq (later Iran), Italy, Jordan, Libya, Morocco, Portugal, Rwanda, South Africa, Spain, Sudan and Yugoslavia; three of Italian Air Force convertible for medevac.

COSTS: 50EX USD20.6 million (2004).

DESIGN FEATURES: Three-engine layout permits overflight of oceans and desert areas within public transport regulations. Sharply waisted rear fuselage and engine pod designed by computational fluid dynamics; wing has compound leading-edge sweep (24° 50' to 29° at quarter-chord) and optimised section.

FLYING CONTROLS: Fully powered controls with pushrods, dual-barrel hydraulic actuators and artificial feel; variable incidence anhedral tailplane with dual electrical actuation by screwjack; drooped leading-edge inboard and slats outboard; double-slotted flaps; three two-position airbrake/spoiler panels on each wing.

STRUCTURE: All-metal, circular-section fuselage with rear baggage compartment inside pressure cabin; wing boxes are integral fuel tanks bolted to carry-through box. Carbon fibre



Dassault Falcon 50 long-range three-turboprop business transport (Dennis Punnett)

0507137

horizontal tail surfaces introduced during 2001. Latécoère, Potez, Reims Aviation, SECCA and Socata are subcontractors on the programme; other suppliers include Dassault Equipements (flight controls, flaps, slats and airbrakes), Liebherr-Aerospace Toulouse (engine bleed air system); SARMA (flight control actuating rods) and Sully Produits Spéciaux (windscreen panels).

LANDING GEAR: Retractable tricycle type by Messier-Dowty, with twin wheels on each unit. Hydraulic retraction, main units inward, nosewheels forward. Nosewheels steerable ±60° for taxiing, ±180° for towing. ABS wheels, brakes and braking system. Mainwheel tyres size 26x6.6 (14 ply) or 26x6.6R14 tubeless, pressure 14.55 bar (211 lb/sq in). Nosewheel tyres size 14.5x5.5-6 (14 ply) tubeless, pressure 9.31 bar (135 lb/sq in). Four-disc brakes designed for 400 landings with normal energy braking. Minimum ground turning radius (about nosewheels) 13.54 m (44 ft 5 in).

POWER PLANT: Three Honeywell TFE731-40 turboprops, each rated at 16.46 kN (3,700 lb st) at ISA + 17°C. Two engines pod-mounted on sides of rear fuselage, third attached by two top mounts. Thrust reverser on centre engine. Fuel in integral tanks, with capacity of 5,787 litres (1,529 US gallons; 1,273 Imp gallons) in wings and 2,976 litres (786 US gallons; 655 Imp gallons) in fuselage tanks. Total fuel capacity 8,763 litres (2,315 US gallons; 1,928 Imp gallons). Single-point pressure fuelling. Inter-technique fuel distribution and gauges.

ACCOMMODATION: Standard accommodation for two crew and nine passengers. In typical arrangement, cabin is divided into a forward section with four armchairs and two fold-out tables, and a rear section with three-seat sofa (convertible into a single bed) and two armchairs separated by a fold-out table; two galleys at forward end of cabin, toilet at rear. Alternative layouts to customer choice, with accommodation for a maximum of 19 passengers. Cabin and rear baggage compartment are pressurised and air conditioned; Barber-Colman temperature controls. Access is by separate door on port side.

SYSTEMS: Air conditioning system utilises bleed air from all three engines or APU. Maximum pressure differential 0.63 bar (9.14 lb/sq in). Pressurisation maintains a maximum cabin altitude of 2,440 m (8,000 ft) to a flight altitude of 14,935 m (49,000 ft). Two independent Messier-Bugatti and Vickers-Sterer hydraulic systems, pressure 207 bar (3,000 lb/sq in), with three engine-driven pumps and one emergency electric pump, actuate primary flying controls, flaps, slats, landing gear, wheel brakes, airbrakes and nosewheel steering. Plain reservoir, pressurised by bleed air at 1.47 bar (21 lb/sq in). 28 V DC electrical system, with a 9 kW 28 V DC Auxilec starter/generator on each engine and two 23 Ah batteries. Labinal electrical harnesses. Wing leading-edge, centre engine S-duct and engine nacelles have engine bleed air anti-icing. Automatic emergency oxygen system. Honeywell 36-150 APU standard.

AVIONICS: *Comms:* Dual Rockwell Collins VHF and mode S transponders; dual Rockwell Collins HF-9000 HF transceivers with Selcal; Teledyne Controls MagnaStar or Honeywell Flitefone 800 radiotelephones; cockpit voice recorder and ELT standard.

Radar: Rockwell Collins TWR 850 Doppler turbulence detection weather radar.
Flight: Dual Rockwell Collins VIR-432 VOR, ADF-462 and DME-442. Rockwell Collins APS-4000 autopilot, ADC-850C air data systems, dual Honeywell FHS-6100 with integrated GPS receiver, Honeywell EGPWS and dual Honeywell Laseref III laser gyro inertial reference systems standard. Dual Universal UNS-1C FMS optional, replacing GNS-XES.



Dassault Falcon 50 executive tri-jet (Paul Jackson)

1153767

Instrumentation: Rockwell Collins Pro Line 4 (EFIS-4000) four-tube EFIS; Thales three-tube LCD engine indicating electronic display (EIED).

DIMENSIONS, EXTERNAL:

Wing span	18.85 m (61 ft 10 in)
Wing chord (mean)	2.84 m (9 ft 3¼ in)
Wing aspect ratio	7.6
Length: overall	18.52 m (60 ft 9¼ in)
fuselage	17.66 m (57 ft 11 in)
Height overall	6.98 m (22 ft 10¼ in)
Tailplane span	7.74 m (25 ft 4¾ in)
Wheel track	3.98 m (13 ft 0¾ in)
Wheelbase	7.24 m (23 ft 9 in)
Passenger door: Height	1.52 m (4 ft 11¾ in)
Width	0.80 m (2 ft 7½ in)
Height to sill	1.30 m (4 ft 3¼ in)
Emergency exits (each side, over wing):	
Height	0.92 m (3 ft 0¼ in)
Width	0.51 m (1 ft 8 in)
Baggage door: Height	0.73 m (2 ft 4¾ in)
Width	0.99 m (3 ft 3 in)

DIMENSIONS, INTERNAL:

Cabin, incl forward baggage space and rear toilet:	
Length	7.16 m (23 ft 6 in)
Max width	1.86 m (6 ft 1 in)
Max height	1.80 m (5 ft 10¼ in)
Volume	20.2 m³ (712 cu ft)
Baggage volume: external	2.55 m³ (90.0 cu ft)
internal	0.71 m³ (25 cu ft)

AREAS:

Wings, gross	46.83 m² (504.1 sq ft)
Horizontal tail surfaces (total)	13.35 m² (143.69 sq ft)
Vertical tail surfaces (total)	9.82 m² (105.70 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	9,603 kg (21,170 lb)
Basic operating weight	9,888 kg (21,800 lb)
Baggage capacity (rear)	1,000 kg (2,205 lb)
Max payload: normal	1,710 kg (3,770 lb)
with max fuel	1,170 kg (2,579 lb)
Max usable fuel	7,040 kg (15,520 lb)
Max T-O weight: standard	18,007 kg (39,700 lb)
optional	18,497 kg (40,780 lb)
Max ramp weight: standard	18,098 kg (39,900 lb)
optional	18,497 kg (40,780 lb)
Max zero-fuel weight	11,598 kg (25,570 lb)
Max landing weight	16,200 kg (35,715 lb)
Max wing loading	384.5 kg/m² (78.75 lb/sq ft)
Max power loading	365 kg/kN (3.58 lb/lb ft)

PERFORMANCE:

Max operating Mach No. (MMO)	0.86
Max operating speed (VMO):	
at S/L	350 kt (648 km/h; 402 mph) IAS
at FL237	370 kt (685 km/h; 425 mph) IAS
Max cruising speed	M0.85 or 487 kt (902 km/h; 560 mph)
Normal cruising speed	M0.80 or 459 kt (850 km/h; 528 mph)
Long-range cruising speed at FL350	M0.75 (430 kt; 797 km/h; 495 mph)
Approach speed, eight passengers and NBAA IFR reserves	106 kt (196 km/h; 122 mph)
Initial cruising altitude	12,497 m (41,000 ft)
Max certified altitude	14,935 m (49,000 ft)
Time to climb to FL410	23 min
FAR Pt 25 balanced T-O field length, S/L, ISA with eight passengers and max fuel	1,490 m (4,890 ft)
FAR Pt 91 landing distance at MLW with eight passengers and NBAA IFR reserves	666 m (2,185 ft)
Range with eight passengers and NBAA IFR reserves:	
at M0.80	3,075 n miles (5,694 km; 3,538 miles)
at M0.75	3,285 n miles (6,083 km; 3,780 miles)

OPERATIONAL NOISE LEVELS:

T-O	83.0 EPNdB
Approach	95.2 EPNdB
Sideline	92.7 EPNdB

DASSAULT FALCON 900

Spanish Air Force designation: T.18
TYPE: Long-range business tri-jet.

PROGRAMME: DEVELOPMENT MILESTONES

Falcon 900	
Announced	27 May 83
First flight	21 Sep 84
Certification	Mar 86
Subsequent versions	
Falcon 900EX	
Announced	Oct 94
Rolled out	13 Mar 95
First flight	1 Jun 95
Certification	31 May 96
First delivery	1 Nov 96
Falcon 900C	
Announced	Jun 98
First flight	17 Dec 98
Certification	15 Jun 99

Falcon 900 announced 27 May 1983; first flight of prototype (F-GIDE *Spirit of Lafayette*) 21 September 1984, second aircraft (F-GFJC) 30 August 1985; flew non-stop 4,305 n miles (7,973 km; 4,954 miles) Paris to Little Rock, Arkansas, September 1985; returned Teterboro, New Jersey, to Istres, France, at M0.84; French and US certification March 1986.

including status close to FAR Pts 25 and 55 for damage tolerance of entire airframe. Prototype Falcon 900 in use as testbed (first flight 12 April 1994) for new laminar flow wing section intended to provide significant reductions in drag. New section installed as sleeve on inner wing and designed to demonstrate hybrid laminar flow with boundary layer suction via seven channels in laser-drilled titanium skin over some 10 per cent chord of upper wing surface. Following test programme, modified aircraft has returned to Dassault Falcon Service to validate laminar flow capability under normal commercial operating conditions. The 250th Falcon 900 series aircraft was delivered in mid-2000.

CURRENT VERSIONS: **Falcon 900B:** French and UK certification received end 1991; complies with FAR Pt 36 Stage III and ICAO 16 noise requirements; approved for Cat. II approaches, for operations from unpaved fields; re-engined with TFE731-5BR-1C turbofans, to give 5.5 per cent power increase; initial cruising altitude 11,855 m (39,000 ft) and NBAA IFR range increased by 100 n miles (185 km; 115 miles); retrofit offered to existing operators. Supplanted by Falcon 900C.

Falcon 900C: Announced 26 June 1998. Combines airframe, engines and cabin of 900B with Honeywell Primus 2000 avionics of 900EX, but without autothrottles; 900B F-WWFP/F-GRDP (c/n 169) served as prototype for certification; first flown 17 December 1998; deliveries began in December 1999 (c/n 180 to Sony Aviation Corp in USA), replacing 900B on production line. French DGAC certification achieved 15 June 1999, with FAA approval following on 26 August 1999.

Detailed description applies to Falcon 900C, except where indicated.

Falcon 900DX: Announced at the European Business Aviation Convention and Exhibition at Geneva 24 May 2004 as replacement for Falcon 900C. Features the Falcon 900EX's Honeywell TFE731-60 engines and Dassault EASy flight deck, but with fuel capacity reduced to 8,541 kg (18,830 lb). Provisional data include: cost USD31.65 million (2004); operating cost five per cent less than that of Falcon 900C; equipped operating weight 11,099 kg (24,470 lb); maximum T-O weight 21,183 kg (46,700 lb); initial cruising altitude 12,497 m (41,000 ft); time to climb to FL370 17 minutes; T-O balanced field length 1,490 m (4,890 ft); maximum range with eight passengers at M0.75 with NBAA IFR reserves 4,100 n miles (7,593 km; 4,718 miles). First flight (F-WWFA) 13 May 2005. Certification by EASA October 2005 and by FAA 4 November 2005.

Falcon 900EX: Long-range development of 900B, announced October 1994. Re-engined with 22.24 kN (5,000 lb st) (ISA+17°C) Honeywell TFE731-60 turbofans, to give 5.8 per cent increase in retained thrust at 12,200 m (40,000 ft) and more than 8 per cent improvement in cruise specific fuel consumption. Engine nacelles, pylons, thrust reversers and portions of centre engine S-duct redesigned; maximum fuel capacity increased to 11,854 litres (3,132 US gallons; 2,608 Imp gallons), of which 11,765 litres (3,108 US gallons; 2,588 Imp gallons) usable, by addition of centre-fuselage tank of 591 kg (1,303 lb) capacity and tank in rear fuselage, capacity 240 kg (530 lb).

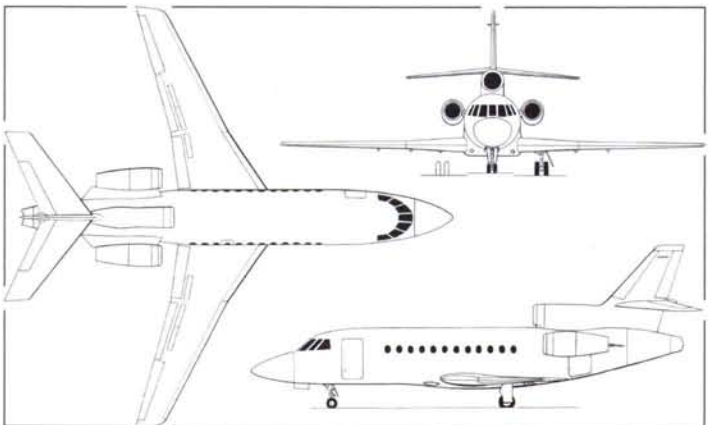
Upgraded standard avionics comprise fully integrated Honeywell Primus 2000 suite with five-tube 20 × 17.75 cm (8 × 7 in) colour EFIS; one engine instrument display; three IC-800 integrated avionics computers; dual FMZ-2000 flight management systems with a third optional; dual fail-operational autopilots; T-O to landing autothrottle; Honeywell EGPWS; dual Laseref III inertial reference systems with third optional; Primus colour weather radar; optional single or dual 12-channel GPS, multichannel satcom, communications management unit (CMU) and Flight Dynamics HGS-2850 head-up display. Dassault EASy integrated flight deck with four 330 × 254 mm (13 × 10 in) active matrix liquid crystal displays (AMLCDs) and trackball-type cursor control device introduced on 900EX EASy from 2003. Other improvements include brake-by-wire system, new fuel quantity management computer, and new cabin pressure controller and emergency oxygen distribution system. First flight with EASy cockpit was made by F-WNCD (c/n 97) on 22 February 2002. EASA and FAA certification achieved 13/14 November 2003. EASy standard from c/n 120 onwards.

Risk-sharing partners, representing 20 per cent of total development investment, are Honeywell (engines and primary avionics), SABCA (centre engine intake cowlings), Hellenic Aircraft Industries (rear fuselage fuel tank), Latécoère (T5 fuselage section and engine pylons), and Alenia (nacelles and centre engine thrust reverser).

Prototype (F-WREX) rolled out 13 March 1995; first flight 1 June 1995; flew Luton, England, to Las Vegas, Nevada, non-stop on 24 September 1995, completing the 4,700 n mile (8,704 km; 5,409 mile) flight in 11 hours 40 minutes including 30 minutes hold for air traffic delays; DGAC certification 31 May 1996; FAA approval granted 19 July after 350-hour flight test programme; first customer delivery to Anheuser-Busch Companies Inc (N200L) 1 November 1996; production aircraft delivered to Little Rock, Arkansas, for outfitting.

Japan MSA: Two Falcon 900s for long-range maritime surveillance entered service with the Japan Maritime Safety Agency September 1989; US search radar, special communications radio, operations control station, U-125A-style search windows and drop hatch for sonobuoys, markers and flares.

Falcon 900 MPA: Maritime Patrol Aircraft, being proposed in mid-2005 for Indian Air Force requirement. Based on Falcon 900DX airframe with Thales Amascos mission equipment comprising Ocean Master maritime search radar, retractable FLIR sensor, tactical datalink and satcom suite; underwing pylons for weapons; and ECM suite. Crew would comprise two pilots, three mission systems operators and two observers. Mission capability could include anti-surface and anti-submarine warfare, target acquisition, intelligence gathering and SAR, with typical on-station time of three hours when operating 1,200 n miles (2,222 km; 1,381 miles) from base.



Dassault Falcon 900C (three Honeywell TFE731 turbofans) (Dennis Punnett)
0507138



Maiden flight of Dassault Falcon 900DX

1153796

CUSTOMERS: Total 203 Falcon 900s and 148 Falcon 900EXs delivered to completion centres by December 2004. Government/VIP versions operated by Algeria, Australia, Belgium, Equatorial Guinea, France, Gabon, Italy, Malaysia, Nigeria, Russia, Saudi Arabia, Spain, Syria and United Arab Emirates. Production totalled 20 in 1998, 24 in 1999, 29 (six 900C and 23 900EX) in 2000, 27 (six 900C and 21 900EX) in 2001, 21 (four 900C and 17 900EX) in 2002, 13 (three 900C, six 900EX and four 900EX EASy) in 2003, 18 (three 900C, one 900EX and 14 900EX EASy) in 2004, and 19 (one 900C, two 900DX and 16 900EX EASy) in 2005.

COSTS: Standard equipped 900C USD31.3 million (2004); 900EX EASy USD34.75 million (2004).

DESIGN FEATURES: Larger cross-section and cabin length than Falcon 50; added economy and further power increase of engines achieved by mixer compound nozzle tailpipe, mixing cold and hot flows.

Wing adapted from Falcon 50 but increased span and area, and optimised for M0.84 cruise; compound leading-edge sweep (24° 50' to 29° at quarter-chord); dihedral 0° 30'.

FLYING CONTROLS: Fully powered flying controls with artificial feel and variable-incidence tailplane as for Falcon 50; full-span slats and double-slotted Fowler flaps; three-position airbrakes.

STRUCTURE: Design and manufacture computer assisted; damage-tolerant structure; extensive use of carbon fibre and aramid (Kevlar); Kevlar radome, wingroot fairings and tailcone; secondary rear cabin pressure bulkhead allows access to baggage in flight and additional protection against pressure loss. Nosewheel doors of Kevlar; mainwheel doors of carbon fibre. Kevlar air intake trunk for centre engine, and rear cowling for side engines. Carbon fibre central cowling around all three engines.

New horizontal tail surface featuring cast titanium central box with resin transfer moulding composite spars and carbon fibre skin panels, resulting in a 13.6 kg (30 lb) reduction in weight, certified by the DGAC in December 1999 and introduced as standard on Falcon 900C and 900EX from December 2000 deliveries.

LANDING GEAR: Retractable tricycle type by Messier-Bugatti, with twin wheels on each unit. Hydraulic retraction, main units inward, nosewheels forward. Oleo-pneumatic shock-absorbers. Mainwheels fitted with Michelin radial tyres size 29x7.7-15, pressure: 900C 13.60 bar (197 lb/sq in), 900EX 13.80 bar (200 lb/sq in). Nosewheel tyres size 17.5x5.75R8, pressure: 900C 10.20 bar (148 lb/sq in, 900EX 10.90 bar (158 lb/sq in). Hydraulic nosewheel steering (±60° for taxiing, ±180° for towing), Messier-Bugatti triple-disc carbon brakes and anti-skid system. Minimum ground turning radius (about nosewheels) 14.55 m (47 ft 8¾ in).

POWER PLANT: Three Honeywell TFE731-5BR-1C turboprops, each rated at 21.13 kN (4,750 lb st) at ISA + 10°C. Thrust reverser on centre engine. Fuel in two integral tanks in wings, capacity 3,428 litres (906 US gallons; 754 Imp gallons) and 3,437 litres (908 US gallons; 756 Imp gallons); forward fuselage tank, capacity 2,061 litres (544 US gallons; 453 Imp gallons), and rear fuselage tank capacity 1,899 litres (502 US gallons; 418 Imp gallons), for total fuel capacity of 10,825 litres.

ACCOMMODATION: Type III emergency exit on starboard side of cabin permits wide range of layouts for up to 19 passengers. Flight deck for two pilots, with central jump-seat. Flight deck separated from cabin by door, with crew wardrobe and baggage locker on either side. Galley at front of main cabin, on starboard side opposite main cabin door. Passenger area is divided into three lounges. Forward zone has four 'sleeping' swivel chairs in facing pairs with tables. Centre zone is dining area, with two double seats facing a transverse table. On starboard side, storage cabinet contains foldaway bench, allowing five to six persons to be seated around table, while leaving emergency exit clear. In rear zone, inward-facing three-seat settee on starboard side converts into a bed. On port side, two armchairs are separated by a table. At rear of cabin, a door leads to toilet compartment, on starboard side, and a second structural plug door to large rear baggage area. Baggage door is electrically actuated.

Other interior configurations available. Alternative eight-passenger configuration has bedroom at rear and three personnel seats in forward zone. A 15-passenger layout divides a VIP area at rear from six (three-abreast) chairs forward; full fuel can still be carried with 15 passengers. The 18-passenger scheme has four rows of three-abreast airline-type seats forward, and VIP lounge with two chairs and settee aft. Many optional items, including additional windows, front toilet unit, video system with one or more monitors, 'Airshow 200' navigation display system, compact disc deck, aft cabin partition, one or two couches

in aft cabin convertible to bed(s), storage cabinet in baggage hold, aft longitudinal table, individual listening devices for passengers, lifejackets and rafts.

SYSTEMS: Air conditioning system uses engine bleed air or air from Honeywell GTCP36-150 APU installed in rear fuselage. Softair pressurisation system, with maximum differential of 0.64 bar (9.3 lb/sq in), maintains sea level cabin environment to height of 7,620 m (25,000 ft), and cabin equivalent of 2,440 m (8,000 ft) at 15,550 m (51,000 ft). Cold air supply by single oversize air cycle unit. Two independent hydraulic systems, pressure 207 bar (3,000 lb/sq in), with three engine-driven pumps and one emergency electric pump, actuate primary flying controls, flaps, slats, landing gear retraction, wheel brakes, airbrakes, nosewheel steering and thrust reverser. Bootstrap hydraulic reservoirs. DC electrical system supplied by three 9 kW 28 V Auxilec starter/generators and two 23 Ah batteries. Heated bleed air anti-icing of wing leading-edges, intakes and centre engine duct; electrically heated windcreens, Eros (SFIM/Intertechnique) oxygen system.

AVIONICS: Comms: Honeywell Primus 2000 as core system.

Radar: Honeywell Primus 870 colour weather radar.

Flight: Dual autopilot, Honeywell FMZ-2000 FMS with two AZ-840 micro air data systems and two Laseref III LINS; Rockwell Collins dual VIR-432 VOR/ILS marker receiver, dual ADF-462 and DME-442; Honeywell AA-300 radar altimeter and IC-800 autopilot; and Honeywell EGPWS.

Instrumentation: Honeywell Primus 2000 five-tube EFIS, comprising two MFDs, two PFDS and one EIED, each measuring 203 × 178 mm (8 × 7 in). Flight Dynamics HGS-2850 head-up guidance system optional.

DIMENSIONS, EXTERNAL:

Wing span	19.33 m (63 ft 5 in)
Wing chord: at root	4.08 m (13 ft 4¾ in)
at tip	1.12 m (3 ft 8 in)
Wing aspect ratio	7.6
Length overall	20.21 m (66 ft 3¾ in)
Fuselage: Max diameter	2.50 m (8 ft 2½ in)
Height overall	7.55 m (24 ft 9¼ in)
Tailplane span	7.74 m (25 ft 4¾ in)
Wheel track	4.45 m (14 ft 7¼ in)
Wheelbase	7.90 m (25 ft 11 in)
Passenger door: Height	1.72 m (5 ft 7¾ in)
Width	0.80 m (2 ft 7½ in)
Height to sill	1.64 m (5 ft 4½ in)
Emergency exit (overwing, stbd):	
Height	0.92 m (3 ft 0¼ in)
Width	0.53 m (1 ft 8¾ in)
Baggage door: Height	0.75 m (2 ft 5½ in)
Width	0.95 m (3 ft 1½ in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck, incl toilet, excluding baggage compartments:	
Length	10.11 m (33 ft 2 in)
Max width	2.34 m (7 ft 8¼ in)
Width at floor	1.91 m (6 ft 3¼ in)
Max height	1.88 m (6 ft 2 in)
Volume	35.8 m³ (1,264 cu ft)
Rear baggage compartment volume	3.6 m³ (127 cu ft)
Flight deck volume	3.8 m³ (132 cu ft)

AREAS:

Wings, gross	49.00 m² (527.4 sq ft)
Vertical tail surfaces (total)	9.82 m² (105.7 sq ft)
Horizontal tail surfaces (total)	13.35 m² (143.7 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped (900C):	10,830 kg (23,875 lb)
900EX	10,829 kg (23,875 lb)
Basic operating weight: 900C	10,977 kg (24,200 lb)
900DX	11,099 kg (24,470 lb)
900EX	11,204 kg (24,700 lb)

Max payload: 900C	1,823 kg (4,020 lb)
900DX	2,900 kg (6,393 lb)
900EX	2,796 kg (6,164 lb)
Payload with max fuel: 900C	1,059 kg (2,335 lb)
900DX	1,633 kg (3,600 lb)
900EX	1,270 kg (2,800 lb)
Max usable fuel: 900C	8,693 kg (19,165 lb)
900DX	8,541 kg (18,830 lb)
900EX	9,525 kg (21,000 lb)
Max ramp weight: 900C standard	20,729 kg (45,700 lb)
900C optional	21,183 kg (46,700 lb)
900DX	21,273 kg (46,900 lb)
900EX standard	22,000 kg (48,500 lb)
900EX optional	22,317 kg (49,200 lb)
Max T-O weight: 900C standard	20,640 kg (45,500 lb)
900C optional	21,092 kg (46,500 lb)
900EX standard	21,909 kg (48,300 lb)
900DX	21,182 kg (46,700 lb)
900EX optional	22,226 kg (49,000 lb)
Max landing weight:	
900C, 900EX standard	19,050 kg (42,000 lb)
900DX	19,141 kg (42,200 lb)
900EX optional	20,185 kg (44,500 lb)
Normal landing weight, eight passengers and fuel reserves: 900C	12,639 kg (27,865 lb)
900EX	12,750 kg (28,110 lb)
900DX	12,846 kg (28,321 lb)
Max zero-fuel weight: 900C standard	12,800 kg (28,220 lb)
900C optional, 900DX, 900EX	14,000 kg (30,865 lb)
Max wing loading:	
900C standard	421.2 kg/m ² (86.27 lb/sq ft)
900C optional	430.5 kg/m ² (88.17 lb/sq ft)
900DX	432.3 kg/m ² (88.55 lb/sq ft)
900EX standard	447.1 kg/m ² (91.58 lb/sq ft)
900EX optional	453.6 kg/m ² (92.91 lb/sq ft)
Max power loading:	
900C standard	326 kg/kN (3.19 lb/lb st)
900C optional	333 kg/kN (3.26 lb/lb st)
900EX standard	328 kg/kN (3.22 lb/lb st)
900EX optional	333 kg/kN (3.27 lb/lb st)
PERFORMANCE (at AUW of 12,250 kg; 27,000 lb, except where indicated):	
Max operating speed (VMO): 900C, 900DX, 900EX:	
at S/L	M0.87 (350 kt; 648 km/h; 403 mph IAS)
between FL100 and FL250	M0.84 (370 kt; 685 km/h; 425 mph IAS)
Max cruising speed:	
900C, 900DX, 900EX	M0.84 or 481 kt (891 km/h; 554 mph)
Normal cruising speed:	
900C, 900DX, 900EX	M0.80 or 459 kt (850 km/h; 528 mph)
Long-range cruising speed:	
900C, 900DX, 900EX	M0.75 or 430 kt (796 km/h; 495 mph)
Approach speed, eight passengers and NBAA IFR fuel reserves:	
900C	107 kt (199 km/h; 124 mph)
900DX, 900EX	109 kt (202 km/h; 126 mph)
Stalling speed:	
900C, 900EX, clean	106 kt (196 km/h; 122 mph)
900C, 900EX, landing configuration	85 kt (158 km/h; 98 mph)
Initial cruising altitude:	
900C, 900DX, 900EX	11,885 m (39,000 ft)
Max certified altitude:	
900C, 900DX, 900EX	15,550 m (51,000 ft)
Balanced T-O field length, FAR Pt 25, at standard max T-O weight:	
900C	1,504 m (4,935 ft)
900DX	1,490 m (4,890 ft)
900EX	1,590 m (5,215 ft)
Landing run, FAR Pt 91:	
900C	716 m (2,350 ft)
900DX	721 m (2,365 ft)
900EX	724 m (2,375 ft)
Range with NBAA IFR reserves:	
900C: with five passengers at M0.75	4,000 n miles (7,408 km; 4,603 miles)
at M0.80	3,830 n miles (7,093 km; 4,407 miles)
900EX with eight passengers:	
at M0.84	3,825 n miles (7,083 km; 4,401 miles)
at M0.80	4,335 n miles (8,028 km; 4,988 miles)
at M0.75	4,500 n miles (8,334 km; 5,178 miles)
OPERATIONAL NOISE LEVELS:	
T-O: 900C, 900DX, 900EX	79.8 EPNdB
Approach: 900C	91.7 EPNdB
900DX, 900EX	92.3 EPNdB
Sideline: 900C	91.2 EPNdB
900DX, 900EX	90.5 EPNdB

DASSAULT FALCON 2000

TYPE: Business jet.

PROGRAMME:

DEVELOPMENT MILESTONES

Falcon 2000	
Announced	Jun 89
Launched	4 Oct 89
First order	4 Oct 89
First flight	24 Mar 93
First flight, production	10 May 94
Certification	30 Nov 94
Subsequent versions	
Falcon 2000EX	
Announced	10 Oct 00
Rolled out	19 Jul 01
First flight	25 Oct 01



Dassault Falcon 2000 (Paul Bowen, Dassault)

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First flight, EASy flight deck	29 Jan 03
Certification	21 Mar 03
First delivery	2Q 03

Announced Paris Air Show 1989 as Falcon X; follow-on to Falcon 20/200; launched as Falcon 2000 on 4 October 1990, following first orders; Alenia joined as 25 per cent risk-sharing partner February 1991, with responsibility for rear fuselage section and engine nacelles; selection of CFE738 engine announced 2 April 1990; first flight (F-WNAV) 4 March 1993; one prototype only; third airframe (F-WWFA) was second to fly, on 10 May 1994; ferried 'green' to US subsidiary Dassault Falcon Jet Corporation at Little Rock, Arkansas, 13 July 1994 for completion as US demonstrator, and set two world speed records 31 October to 1 November 1994 flying Los Angeles (Chino) to Bangor, Maine, in 4 hours 36 minutes 27 seconds and Bangor to Paris in 5 hours 26 minutes 12 seconds; Dassault demonstrator, second airframe (F-WNEW), flew 11 July 1994.

JAA certification to JAR 25 obtained 30 November 1994, at which time five aircraft (prototype, two demonstrators and two customer aircraft) had accumulated 1,055.5 flight hours; FAR Pt 25 and FAR Pt 36 Stage 3 noise levels certification 2 February 1995; first delivery (F-WNEW/ZS-NNF to South African customer) 16 February 1995. Approved to operate into London City Airport during 1996. Commonwealth of Independent States certification 14 April 1997. HGS-2850 HUD first flown in prototype 8 December 1995; initial JAA certification granted 30 August 1996, followed by approval for low-visibility take-offs (down to 91 m; 300 ft RVR) and hand-flown Cat. II and Cat. IIIa instrument approach approved by FAA 30 July 1997, Full JAA certification 16 December 1997; FAA certification 18 May 1998.

CURRENT VERSIONS: **Falcon 2000**: Initial production version, *As described*.

Falcon 2000EX: Extended-range version. Development began October 1999; announced at the NBAA Convention in New Orleans, 10 October 2000. Prototype (c/n 01/F-WMEX) rolled out 19 July 2001 and first flown 25 October 2001; two aircraft (F-WMEX and c/n 02/F-WWGA). Completed 568 hours of flight testing in 242 flights, culminating in JAA and FAA certification on 21 March 2003; first three 'green' production airframes delivered to Little Rock completion centre in January 2003, with first customer deliveries of outfitted aircraft beginning in the second quarter of 2003 (Pro Line avionics). EASy flight deck available from second quarter of 2004. Falcon 2000EX manufactured in parallel with Falcon 2000.

New features include two Pratt & Whitney Canada PW308C turbofans, with FADEC, each rated at 31.1 kN (7,000 lb st) for take-off at ISA +15 °C; Nordam advanced single pivot (ASP) thrust reversers; revised fuel system with 2,044 kg (4,506 lb) increase in usable fuel capacity to 9,497 litres (2,509 US gallons; 2,089 Imp gallons) gross; strengthened main landing gear with heavy-duty braking system brake/steering control unit, and Falcon 900EX nose landing gear; and new bleed air system. Early Falcon 2000EXs retained the Collins Pro Line 4 avionics suite, but aircraft delivered from 2004 equipped with Dassault EASy flight deck (major modification M1691) with four-tube flat panel displays based on those of the Honeywell Primus Epic modular avionics system and designated **Falcon 2000EX EASy**; first flight with EASy cockpit c/n 6/F-WXEY) 29 January 2003; EASA and FAA certification on 22 June 2004; equips aircraft Nos. 6 and 28 onwards.

Falcon 2000DX: Shorter-range variant of Falcon 2000EX; announced on eve of NBAA Convention in Orlando 8 November 2005; first flight scheduled for June 2007, with certification and first deliveries anticipated at the end of that year. Retains Falcon 2000EX EASy's engines, flight deck and systems, with ventral fuel tank of reduced capacity. Provisional data include max ramp weight and max T-O weights 136 kg (300 lb) less than those of Falcon 2000EX EASy; max fuel weight 6,622 kg (14,600 lb); time to climb to FL410 17 minutes; T-O run 1,463 m (4,800 ft); range with six passengers at M0.80 with NBAA IFR reserves 3,250 n miles (6,019 km; 3,740 miles). Replaces Falcon 2000 from late 2007, initial production aircraft being c/n 232.

CUSTOMERS: The 230th Falcon 2000 was delivered to a customer on 2 October 2006, while 106th Falcon 2000EX arrived at Little Rock on 31 October 2006. Production totalled 35 in 2001, 35 in 2002, 28 in 2003, 29 in 2004, (comprising 10 2000EXs and 19 2000EX EASys), 27 in 2005, (comprising six 2000s and 21 2000EX EASys), and 23 in the first nine months of 2006 (comprising six 2000s and 17 200EX EASys). Falcon 2000 No. 159/N259QS, delivered to Executive Jet on 11 September 2001, was also 1,500th Falcon/Mystère business jet produced by Dassault. Total of 72 Falcon 2000s, and 28 Falcon 2000EXs, ordered by NetJets and NetJets Middle East fractional ownership programmes in Europe, Middle East and USA, of which 92 were in operation by October 2004. Total market estimated at more than 300 in 2005.

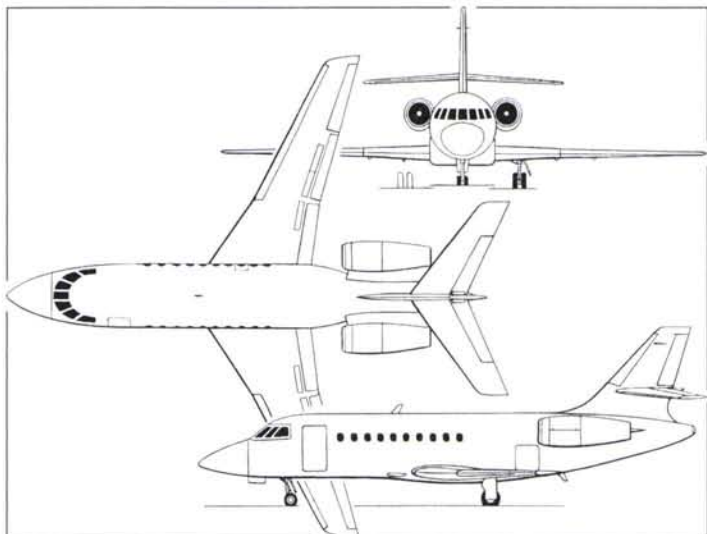
COSTS: Basic price 2000 USD23.2 million; 2000EX USD24.97 million (both 2004).

DESIGN FEATURES: Same fuselage cross-section as Falcon 900, but 1.98 m (6 ft 6 in) shorter. Design Falcon 900 wing with modified leading-edge and no inboard slats; sweepback at quarter-chord 24° 50' to 29°.

FLYING CONTROLS: Fully powered. Two-section flaps and three-section spoilers each side. Variable incidence tailplane. Leading-edge inboard slats. Maximum control surface movements: elevators +20°/-16°; ailerons +25° 20°/-24° 50'; rudder ±29°; flaps -40°; airbrakes, inboard +68°, centre +50°, outboard +37°; leading-edge slats -30°.

STRUCTURE: Largely as for Falcon 900. Rear fuselage, including engine pods and pylons, by Alenia and Piaggio; thrust reversers by Dee Howard. Agreement reached in early 2002 for production of fuselage components of 2000EX by Chengdu Aircraft of China. New horizontal tail surface featuring cast titanium central box with resin transfer moulding composite spars and carbon fibre skin panels, resulting in a 13.6 kg (30 lb) reduction in weight, certified by the DGAC in December 1999 and introduced as standard from December 2000 deliveries.

LANDING GEAR: Retractable tricycle type; mainwheels retract inwards, nosewheel forwards. Main tyres 26x6.6R14 (14 ply) tubeless; nose 14.5x5.5R6 tubeless. Tyre pressures: 2000



Dassault Falcon 2000 twin-engined business transport (Dennis Punnett)

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main 13.6 bar (197 lb/sq in), nose 11.1 bar (161 lb/sq in); 2000EX main 15.1 bar (219 lb/sq in), nose 12.6 bar (183 lb/sq in). Steerable nosewheel ($\pm 60^\circ$). Minimum turning radius on ground 15.03 m (49 ft 3 3/4 in).

POWER PLANT: Two CFE CFE738-1-1B turbopfans, each rated at 25.5 kN (5,725 lb st). Fuel of Falcon 2000 contained in six integral tanks (three each, outboard wing, inboard wing and centre wing box, port and starboard sides) plus two feeder tanks, combined capacity 6,927 litres (1,830 US gallons; 1,524 Imp gallons), of which 6,867 litres (1,814 US gallons; 1,510 Imp gallons) are usable. Falcon 2000X has 3,441 litres (909 US gallons; 757 Imp gallons) in port wing; 3,452 litres (912 US gallons; 759 Imp gallons) in starboard wing; 1,109 litres (293 US gallons; 244 Imp gallons) in rear fuselage; 1,450 litres (383 US gallons; 319 Imp gallons) in rear fuselage for usable total of 9,452 litres (2,497 US gallons; 2,079 Imp gallons) or 9,497 litres (2,509 US gallons; 2,089 Imp gallons) gross. Dee Howard clamshell-type thrust reversers certified by FAA and JAA during 1995.

ACCOMMODATION: Up to 19 passengers and two flight crew; standard passenger accommodation is four seats in forward lounge and four seats and a two-person sofa in aft lounge. Pressurised, flight accessible baggage compartment at rear of cabin.

SYSTEMS: Honeywell GTC36-150(F2M) APU, with start up approval to 10,668 m (35,000 ft). **AVIONICS:** Rockwell Collins Pro Line 4.

Comms: Dual com/nav; dual TRD-94D Mode-S transponders; dual RTU-4420 radio tuning units; Rockwell Collins HF-9000 transceiver.

Radar: Rockwell Collins WXR-840 colour weather radar standard; TWR-850 Doppler weather radar optional.

Flight: Rockwell Collins FMS-6100 flight management system and Cat. II autopilot standard. Rockwell Collins dual DME-442, dual ADF-462; dual AHRS and dual digital air data computers linked to dual-channel integrated avionics processor system (IAPS). Dual Honeywell Laserref III, Honeywell EGPWS, IRS, second FMS (with GPS), flight data recorder, traffic alert and collision avoidance system (TCAS) and GPWS all optional.

Instrumentation: Rockwell Collins Pro Line 4 four-tube EFIS-4000. Sextant Avionique three-tube engine indicating electronic display (EIED); Flight Dynamics HGS-2850 HUD.

Mission: Optional satcom antenna in fin tip pod.

Data below apply to Falcon 2000 and 2000EX unless otherwise indicated.

DIMENSIONS, EXTERNAL:

Wing span	19.33 m (63 ft 5 in)
Wing chord (mean)	2.89 m (9 ft 5 3/4 in)
Wing aspect ratio	7.6
Length overall	20.22 m (66 ft 4 in)
Height overall	7.06 m (23 ft 2 in)
Wheel track	4.45 m (14 ft 7 1/4 in)
Wheelbase	7.39 m (24 ft 3 in)
Passenger door: Height	1.72 m (5 ft 7 3/4 in)
Width	0.80 m (2 ft 7 1/2 in)
Baggage door: Height	0.775 m (2 ft 6 1/2 in)
Width	0.75 m (2 ft 5 1/2 in)
Emergency exits (Type III): Height	0.92 m (3 ft 0 1/4 in)
Width	0.53 m (1 ft 8 3/4 in)

DIMENSIONS, INTERNAL:

Cabin: Length	7.98 m (26 ft 2 1/4 in)
Width: max	2.34 m (7 ft 8 1/4 in)
at floor level	1.91 m (6 ft 3 1/4 in)
Max height	1.88 m (6 ft 2 in)
Volume	29.0 m ³ (1,024 cu ft)
Baggage volume: 2000	3.8 m ³ (134 cu ft)
2000EX	3.7 m ³ (131 cu ft)

AREAS:

Wings, gross	49.02 m ² (527.6 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty, equipped: 2000	9,473 kg (20,885 lb)
2000EX	10,142 kg (22,360 lb)
Basic operating weight: 2000	9,798 kg (21,600 lb)
2000EX	10,519 kg (23,190 lb)
Max payload: 2000	3,202 kg (7,060 lb)
2000EX	2,953 kg (6,510 lb)
Max baggage weight: 2000, 2000EX	726 kg (1,600 lb)

Max usable fuel weight: 2000	5,513 kg (12,154 lb)
2000EX	7,557 kg (16,660 lb)
Max ramp weight: 2000: standard	16,329 kg (36,000 lb)
optional (mod M57)	16,647 kg (36,700 lb)
2000EX: standard	18,824 kg (41,500 lb)
optional (mod 1842)	19,232 kg (42,400 lb)
Max T-O weight: 2000: standard	16,238 kg (35,800 lb)
optional (mod M57)	16,556 kg (36,500 lb)
2000EX: standard	18,733 kg (41,300 lb)
optional (mod M1842)	19,232 kg (42,400 lb)
Max landing weight: 2000	14,970 kg (33,000 lb)
2000EX	17,826 kg (39,300 lb)
Max zero-fuel weight: 2000	13,000 kg (28,660 lb)
2000EX	13,472 kg (29,700 lb)
Max wing loading: 2000:	
standard	331.3 kg/m ² (67.85 lb/sq ft)
optional	337.8 kg/m ² (69.18 lb/sq ft)
2000EX: standard	384.0 kg/m ² (78.65 lb/sq ft)
optional	392.3 kg/m ² (80.36 lb/sq ft)
Max power loading:	
2000 standard	319 kg/kN (3.12 lb/lb st)
optional	325 kg/kN (3.19 lb/lb st)
2000EX: standard	302 kg/kN (3.49 lb/lb st)
optional	306.9 kg/kN (3.01 lb/lb st)

PERFORMANCE:

Max operating Mach No. (MMO): FL250 to FL420	0.86
above FL420	0.85
Max operating speed (VMO):	
FL100 to FL250	350 kt (648 km/h; 403 mph) IAS
above FL250	370 kt (685 km/h; 425 mph) IAS
Max cruising speed: 2000	M0.84 or 481 kt (891 km/h; 554 mph)
Normal cruising speed: 2000EX	M0.85
2000	M0.80 or 459 kt (850 km/h; 528 mph)
Long-range cruising speed:	
2000	M0.75 or 430 kt (796 km/h; 495 mph)
2000EX	M0.77
Approach speed: 2000	109 kt (202 km/h; 125 mph)
2000EX	112 kt (207 km/h; 129 mph)
Initial cruising altitude:	
2000 at M0.80	12,500 m (41,000 ft)
2000 at M0.75	13,100 m (43,000 ft)
2000EX at M0.77	12,500 m (41,000 ft)
Max certified altitude	14,330 m (47,000 ft)
Time to climb to FL410: 2000	24 min
2000EX	21 min
FAR Pt 25 balanced T-O field length, S/L, ISA:	
2000: with eight passengers and max fuel	1,603 m (5,260 ft)
at max T-O weight	1,658 m (5,440 ft)
2000EX:	
at standard MTOW	1,638 m (5,375 ft)
at optional MTOW	1,704 m (5,590 ft)
Landing field length:	
FAR Pt 91 with eight passengers and NBAA IFR reserves	780 m (2,560 ft)
at MLW	952 m (3,125 ft)
2000EX with six passengers and NBAA IFR reserves	797 m (2,615 ft)
Range with eight passengers and NBAA IFR reserves:	
2000: at M0.75	3,090 n miles (5,723 km; 3,556 miles)
at M0.80	3,000 n miles (5,556 km; 3,452 miles)
2000EX with max fuel, six passengers, at Mach 0.80, NBAA IFR reserves	3,800 n miles (7,037 km; 4,373 miles)
g limits	+2.64/-1
OPERATIONAL NOISE LEVELS, 2000:	
T-O	79.4 EPNdB
Approach	93.1 EPNdB
Sideline	86.4 EPNdB

DASSAULT FALCON 7X

TYPE: Long-range business tri-jet.

PROGRAMME: Announced, under temporary name/designation Falcon Next/NXT, at the Paris Air Show in June 2001; then became Falcon FNX; formal designation Falcon 7X announced 29 October 2001. By September 2002, high- and low-speed wind tunnel tests had been conducted at the ONERA facilities in Modane and Toulouse and in the European Transonic Wind Tunnel at Cologne, Germany; design frozen and first metal cut May 2003. First fuselage delivered to final assembly plant on 16 July 2004; rolled out 15 February 2005.

First flight (F-WFBW) 5 May 2005 followed by second aircraft (F-WTDA) on 5 July and third (F-WSKY) on 20 September 2005; total of 100 flights and more than 330 hours completed by three test aircraft by 15 November 2005; public debut (No. 1) at Paris Air Show 13 June 2005; US debut (No. 3) at NBAA Convention, Orlando, Florida, 9 November 2005; fourth aircraft first flew (F-WWUA) 8 June 2006. By December 2006 the four aircraft had accumulated 1,300 hours in more than 450 test flights, which had included the entire performance and centre of gravity envelopes; cold soak trials by F-WTDA at Iqaluit and Resolute Bay, Northern Canada in April 2006; 35 flight hours in natural icing conditions by F-WTDA over France, Italy, Spain and UK in May 2006; flight testing with artificial ice shapes (F-WFBW); contaminated runway trials (F-WSKY) at Cranfield, UK in July 2006; hot weather trials in Tunisia; and high altitude testing in the Western United States in October 2006. First 'green' airframe, c/n 05, delivered to Little Rock completion centre on 12 December 2006. EASA and FAA certification expected in March 2007, and first deliveries in the second quarter of the year. Initial production rate 15 aircraft per year, rising to 40 per year.

CUSTOMERS: Market estimated at 400 aircraft over unspecified period. More than 125 orders held by December 2006. On 26 September 2006, NetJets Europe ordered 24 for delivery

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Dassault Falcon 7X after installation of winglets (Paul Bowen, Dassault)

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between 2008 and 2014. First customer delivery will be to Serge Dassault in April 2007; first delivery to a US customer will be to Anheuser-Busch Companies.

COSTS: Development cost estimated at USD600 million to USD700 million. Unit cost USD40 million basically equipped (2006). NetJets order for 24 aircraft valued at USD1.1 billion (2006).

DESIGN FEATURES: Similar in configuration to Falcon 900C/900EX, but with cabin some 20 per cent longer, redesigned nose, double-curved windscreen panels and an entirely new high-subsonic section wing with 20 per cent fewer parts, 5° more sweepback, (34° on inboard section, 30° on outboard section), 40 per cent more area and featuring full-span, two-section leading-edge slats following initial testing the prototype was retrofitted with winglets which have been adopted as standard on production airframes. The wing design will be employed on future developments within the Falcon range, expected to be designated Falcon 5X and 9X.

FLYING CONTROLS: Fly-by-wire controls, with sidestick controllers.

STRUCTURE: Total of 21 programme partner suppliers announced by May 2003, including: CASA (horizontal stabiliser); Stork-Fokker (trailing-edge control surfaces); Hurel Hispano/Aermacchi (engine nacelles and thrust reversers); Latécoère (T5 fuselage section); Socata (T34 upper fuselage section and body fairing); Sonaca (wing leading-edges); Stork-Fokker (spoilers, flaps, airbrakes and ailerons); and Sully Saint Gobain (windscreen and cabin windows). Final assembly in new 23,226 m² (250,000 sq ft) Charles Lindbergh facility at Bordeaux, with capacity for four Falcon 7Xs per month.

POWER PLANT: Three Pratt & Whitney Canada PW307A turbofans, each flat-rated to 28.5 kN (6,400 lb st) at ISA +17°C. Usable fuel capacity 18,045 litres (4,767 US gallons; 3,969 Imp gallons).

LANDING GEAR: Retractable tricycle type by Messier-Dowty. Wheels and brakes by ABSC. Steerable nosewheel ± 60°. Minimum ground turning radius 8.80 m (61 ft 8 in).

ACCOMMODATION: Typical configuration will provide three lounge areas, berthing capability for six passengers, lavatories, galleys, crew rest area and a large flight-accessible baggage compartment. Pressurisation system will provide a 1,830 m (6,000 ft) cabin environment at high cruise altitudes. Target cabin noise level 52 dB.

SYSTEMS: Honeywell air management system. Pressurisation system maintains 1,830 m (6,000 ft) cabin environment at maximum operating altitude. Honeywell GTPC 36-150F2M APU. Honeywell/Parker hydraulic power generation system. Parker hydraulic system; Intertechnique oxygen system; L'Hotelier fire detection and extinguishing; TRW electrical generation and distribution.

AVIONICS: Dassault EASy flight deck as core system, incorporating Honeywell Primus Epic platform. EMS Technologies AMT-50 satcom antenna.

DIMENSIONS, EXTERNAL:

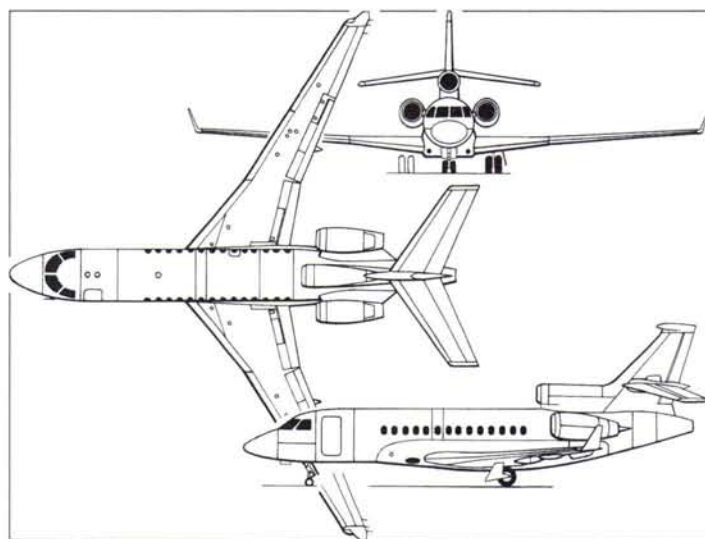
Wing span over winglets	26.21 m (86 ft 0 in)
Wing aspect ratio	9.7
Length overall	23.19 m (76 ft 1 in)
Height overall	7.79 m (25 ft 6 3/4 in)
Wheel track	9.75 m (31 ft 11 3/4 in)
Wheelbase	4.32 m (14 ft 2 in)
Passenger door: Height	1.72 m (5 ft 7 3/4 in)
Width	0.80 m (2 ft 7 1/2 in)
Type III emergency exit: Height	0.91 m (3 ft 0 in)
Width	0.53 m (1 ft 9 in)

DIMENSIONS, INTERNAL:

Cabin	
Length, third flight deck seat to baggage compartment	11.91 m (39 ft 1 in)
Width: max	2.34 m (7 ft 8 in)
at floor level	1.91 m (6 ft 3 1/4 in)
Max height	1.88 m (6 ft 2 in)
Volume	43.95 m ³ (1,554 cu ft)
Baggage compartment volume	4.0 m ³ (141 cu ft)

AREAS:

Wings, gross	70.70 m ² (761.00 sq ft)
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Dassault Falcon 7X (James Goulding)

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WEIGHTS AND LOADINGS:

Basic operating weight	15,546 kg (34,273 lb)
Payload: max	3,052 kg (6,728 lb)
with max fuel	1,355 kg (2,988 lb)
Max fuel weight	14,488 kg (31,941 lb)
Max T-O weight	31,297 kg (69,000 lb)
Max landing weight	28,304 kg (62,400 lb)
Max ramp weight	31,388 kg (69,200 lb)
Max zero-fuel weight	18,597 kg (41,000 lb)
Max wing loading	442.7 kg/m ² (90.67 lb/sq ft)
Max power loading	366 kg/kN (3.59 lb/lb st)

PERFORMANCE:

Max operating Mach No. (MMO)	0.90
Max operating speed (VMO)	370 kt (685 km/h; 425 mph) IAS
Cruising speed: typical	M0.85
for long range	M0.80
Approach speed, landing weight of 16,828 kg (37,100 lb), 8 passengers, NBAA IFR reserves	104 kt (193 km/h; 120 mph)
Max certified altitude	15,545 m (51,000 ft)
FAR Pt 25 balanced T-O field length, S/L, ISA, with eight passengers and max fuel	1,678 m (5,505 ft)
FAR Pt 91 landing distance at max landing weight	1,196 m (3,925 ft)
Range: with three crew, eight passengers and NBAA IFR reserves:	
at M0.80	5,950 n miles (11,019 km; 6,847 miles)

DASSAULT FALCON SMS

At the NBAA Convention in Orlando Florida in October 2006 Dassault announced that, following certification of the Falcon 7X in early 2007 it would begin development of a super-midsize Falcon, provisionally designated SMS, that will be positioned in the Falcon range between the Falcon 50 and Falcon 2000. No further details were revealed.

SUBSIDIARY:

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Tel: (+351 242) 20 13 07
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Dyn'Aéro formed 7 September 1992 by Christophe Robin, son of the founder of Avions Pierre Robin; his initials (CR) appear in aircraft designations. Initial product was CR100, flown two weeks before formation of company. Two new designs derived from CR100 announced in March 1995: CR110 and CR120; simultaneously, MCR01 also announced. The new MCR01 Club flew in June 1998 and a four-seat version in June 2000. Production facilities at Darois

DYN'AERO

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CHAIRMAN: Christophe Robin
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aerodrome comprise 4,000 m² (43,050 sq ft) of workshops, storage and offices. Plans announced in February 2002 for establishment of a subsidiary, Dyn'Aéro Iberica at a new factory in Portugal, permitting an increase in annual production from 50 to 100 aircraft (initially of MCR ULC).

By early 2004, more than 400 Dyn'Aéro kits had been sold and the company workforce numbered 25 in France and 40 in Portugal.

DYN'AERO CR100, CR110 and CR120

TYPE: Side-by-side sportplane/kitbuilt.

PROGRAMME: Prototype CR100 (F-PDYN) first flew 27 August 1992; third aircraft (F-PAFC) was designated CR100D; first five CR100s flew total of 600 hours of aerobatics in first year of operations. Available factory-built or as a kit.

CURRENT VERSIONS: **CR100:** Baseline version, Prototype (F-WASP).

CR100T: Tricycle landing gear version, first flown December 2000.

Description applies to CR100, except where otherwise stated.

CR110: Up-rated version with 149 kW (200 hp) Textron Lycoming engine.

CR120: High-agility version. First flight (F-PPCR) September 1996; second aircraft (F-PTCR) flying by 1998. Engine as CR110, but airframe all carbon fibre; longer span ailerons (2.70 m; 8 ft 10¼ in), no flaps, shorter wing span (7.77 m; 25 ft 6 in), 270°/s rate of roll at 140 kt (260 km/h; 162 mph) compared with CR100's 195°/s, 149 kW (200 hp) Textron Lycoming AEIO-360 engine driving MTV-12-B/C/C-183-17e two-blade propeller, 85 litres (22.4 US gallons; 18.7 Imp gallons) aerobatic fuel in starboard wingroot and 105 litres (27.7 US gallons; 23.1 Imp gallons) in port wingroot, tyre pressure 2.00 bar (29.0 lb/sq in). Aircraft are registered under CR100 designation.

CUSTOMERS: Two CR100s ordered March 1995 by l'Equipe de Voltige de l'Armée de l'Air at Salon de Provence, of which first (No. 22 'CJ') delivered 21 July 1995; however, both withdrawn by 1997 and sold in 2000, one to UK owner Cole Aviation. Total of at least 37 CR100/110/120 kits sold; of these, 16 had been registered by early 2002. There were no known completions or new sales between 2002 and 2005, but production is set to continue at a low rate, reflecting the specialised market for aerobatic aircraft.

COSTS: EUR76,200 as a kit without engine; about EUR137,200 assembled, with engine and instruments.

DESIGN FEATURES: Single-engined low-wing monoplane of conventional layout. Aerofoil section NACA 21015/12 modified; dihedral 0°.

FLYING CONTROLS: Conventional and manual. Elevator tab for pitch trim. Ground-adjustable tab on ailerons on rudder. Plain flaps.

STRUCTURE: Wood and fabric, but including carbon fibre main wing spar.

LANDING GEAR: Tailwheel type; fixed. Wing-mounted, trussed, cantilever main legs with integral oleo-pneumatic shock-absorbers. Wheel fairings on main legs. Disc brakes. Mainwheel tyre size 380×150; pressure 2.30 bar (33.0 lb/sq in).

POWER PLANT: One 134 kW (180 hp) Textron Lycoming AEIO-360-B2F flat-four engine, driving either Evra Fixed-pitch or MT variable-pitch propeller. Compatible with alternative engines of 119 kW (160 hp) and above. Fixed-pitch or constant-speed propellers can be fitted. Fuel capacity for aerobatics 85 litres (22.4 US gallons; 18.7 Imp gallons), of which 82 litres (21.7 US gallons; 18.0 Imp gallons) are usable; max fuel capacity 160 litres (42.3 US gallons; 35.2 Imp gallons). Oil capacity 7.6 litres (2.0 US gallons; 1.7 Imp gallons).

ACCOMMODATION: Two seats, side by side, with dual controls. Fixed windscreen and rearward-sliding canopy.

SYSTEMS: Electrical system: 12 V 30 Ah battery.

AVIONICS: Customer specified.

DIMENSIONS, EXTERNAL:

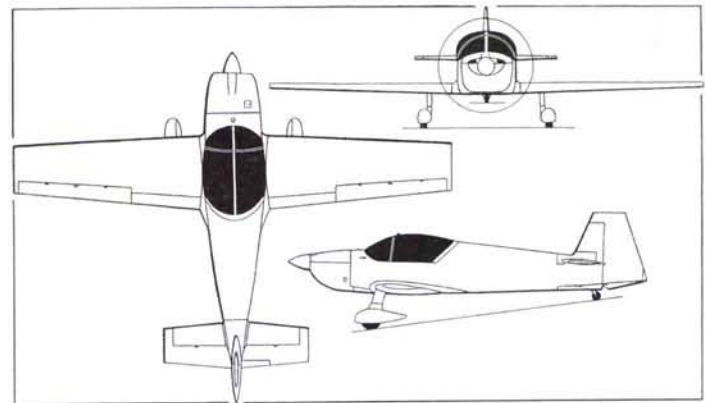
Wing span	8.50 m (27 ft 10½ in)
Wing aspect ratio	6.8
Length overall	7.50 m (24 ft 7¼ in)
Tailplane span	2.80 m (9 ft 2¼ in)
Wheel track	2.37 m (7 ft 9¼ in)
Propeller diameter	1.90 m (6 ft 3 in)

AREAS:

Wings, gross	10.65 m ² (114.6 sq ft)
Ailerons (total)	1.215 m ² (13.08 sq ft)
Trailing-edge flaps (total)	1.21 m ² (13.02 sq ft)
Vertical tail surfaces (total)	1.71 m ² (18.40 sq ft)
Horizontal tail surfaces (total)	2.20 m ² (23.68 sq ft)



Dyn'Aéro CR100 1159268



General arrangement of the Dyn'Aéro CR100 (Paul Jackson) 1159376

WEIGHTS AND LOADINGS:

Weight empty	550 kg (1,213 lb)
Max T-O weight: Aerobatic	760 kg (1,676 lb)
Normal	850 kg (1,873 lb)
Max wing loading: Aerobatic	71.5 kg/m ² (14.64 lb/sq ft)
Normal	80.0 kg/m ² (16.38 lb/sq ft)
Max power loading: Aerobatic	5.66 kg/kW (9.31 lb/hp)
Normal	6.34 kg/kW (10.41 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	205 kt (379 km/h; 235 mph)
Max level speed	165 kt (305 km/h; 190 mph)
Max cruising speed	151 kt (280 km/h; 174 mph)
Manoeuvring speed (VA)	140 kt (260 km/h; 161 mph)
Max rate of climb at S/L	480 m (1,575 ft)/min
T-O run	153 m (500 ft)
T-O to 15 m (50 ft)	351 m (1,150 ft)
Range: normal fuel	302 n miles (560 km; 348 miles)
max fuel	604 n miles (1,120 km; 696 miles)
g limits	+8/-6

DYN'AERO MCR01

TYPE: Side-by-side kitbuilt; side-by-side ultralight kitbuilt.

PROGRAMME: Composites version of the metal MC100 Ban-Bi designed by Michel Colomban; fuselage first shown at RSA Rally in July 1995. Continues to be referred to by some sources as **Ban Bi**. MCR identifies Michel Colomban/Christophe Robin. Prototype (F-PECH) flew 1995.

CURRENT VERSIONS: **MCR01 VLA:** Certified version meeting JAR-VLA requirements; **VLA 912** or **VLA 914**, according to engine. JAR-VLA certification awarded 26 June 2001 in France and 7 December 2001 in Peru.

MCR01 Club: Version of MCR01 VLA intended for flight training. First flight (F-PCLB) June 1998. Certification to JAR-VLA was due in 2001.

MCR01 ULM: Ultralight version meeting FAI ULM requirements; 59.7 kW (80 hp) engine. **MCR01 ULC** has 490 kg (1,080 lb) MTOW and is also known as the **MCR01 SLA** in the UK, where the first example (G-BZXG) made its first flight on 30 November 2001. DGAC certification received 1 March 2001.

Motor Glider: Proposed 'Winggrid' wingtips developed in conjunction with La Roche Consulting of Switzerland; 59.7 kW (80 hp) engine, best glide ratio 30:1; programme since abandoned.

MCR M: Tailwheel version with oleo-pneumatic heavy-duty landing gear. Also known as **MCR Montagne** when marketed in Italy for rough field operation. Certification issued 26 June 2002.

Electra-Plane: Being developed by Advanced Technology Products; stated to be world's first fuel cell-powered aircraft. Prototype is based on MCR01; second prototype will utilise a Hoffmann H-36 Dimona as base aircraft. Three stages planned: first, with lithium-ion batteries, will have 86 n mile (160 km; 100 mile) range; second, with combination of batteries and 10 to 15 kW (13 to 20 hp) fuel cell, will have 217 n mile (402 km; 250 mile) range. Final version will be powered solely with fuel cells and have 434 n mile (804 km; 500 mile) range.

Description applies to all versions except where indicated.

CUSTOMERS: Over 320 kits sold by July 2006, in Austria, Germany, Italy, Japan, Netherlands, New Zealand, Spain, Switzerland, UK and USA. More than 230 flying by early 2005.

COSTS: Kits, less engine and instruments: Sportster EUR28,300, ULC/ULM EUR33,100, Club EUR31,300 (all 2003).

DESIGN FEATURES: Single-engined low-wing monoplane with T tail; design goals include extremely low structural weight, fast kit production and high performance in comfort and safety.

FLYING CONTROLS: Manual. All-moving tailplane with trim tab, which is full span on ULM version; electrically actuated flaps and pitch trim; ULM and M versions have full-span double-slotted flaperons; VLA has flaperons (both three-position: 0, 17, 45°); Club has separate double slotted flaps and ailerons.

STRUCTURE: Wing and control surfaces built on carbon fibre spars and cellular ribs, to which preformed aluminium skins are glued in partial vacuum; monocoque carbon fibre fuselage; quoted build time of 500 to 1,000 hours from three modular kits without special tools. Airframe disassembles for storage or road-towing, with recommended disassembly/reassembly time of 4 minutes, single-handed, Dyn'Aéro proprietary aerofoil. Wing dihedral 3°, incidence 20°, twist 0°.

LANDING GEAR: Tricycle type; fixed, fuselage-mounted spring cantilever mainwheel legs with wheel fairings on all three units; nosewheel steerable. Large wheels optional for rough field operation. Tailwheel configuration optional on MCR01 Club and MCR01 ULC versions, which have further option of wing-mounted, trussed cantilever main legs with integral shock-absorbers. Skis tested on MCR M during winter 2002-03.

POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL; 63.4 kW (85 hp) JPX 4T75; or 73.5 kW (98.6 hp) normally aspirated Rotax 912 ULS or turbocharged Rotax 914 flat-four driving an EVRA 156-178-106 two-blade fixed-pitch propeller optimised for cruise; three-blade MT Propeller MTV-7-A/152-106 or MTV-6-A/152-106 constant-speed propeller optional. Jabiru-powered version first flown 19 April 2002. Standard fuel capacity 80 litres (21.1 US gallons; 17.6 Imp gallons) in all versions; optional additional 90 litre (23.75 US gallon; 19.8 Imp gallon) tank in Club and ULM or 264 litre (69.7 US gallon; 58.1 Imp gallon) tank in VLA.

AVIONICS: To customer's choice.

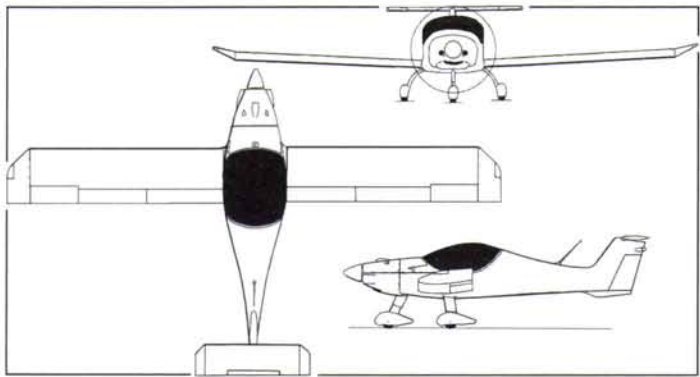
EQUIPMENT: Optional road-towing trailer/storage hangar. BRS ballistic parachute recovery system optional on ULM.

DIMENSIONS, EXTERNAL:

Wing span: VLA	6.66 m (21 ft 10¼ in)
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Dyn'Aéro MCR01 Club version (Paul Jackson) 1159341



MCR01 in its ULC/ULM/VLA form (Paul Jackson)

Club	6.90 m (22 ft 7½ in)
ULM, M	8.64 m (28 ft 4¼ in)
Motor Glider	9.80 m (32 ft 1¾ in)
Wing chord (constant): VLA	0.80 m (2 ft 7½ in)
Club, ULM, M	0.96 m (3 ft 1¾ in)
Wing aspect ratio: VLA	8.5
Club	7.0
ULM	8.6
Length overall: all	5.53 m (18 ft 1¾ in)
Height overall: Club, ULM	1.53 m (5 ft ¼ in)
DIMENSIONS, INTERNAL:	
Cabin max width: all	1.12 m (3 ft 8 in)
AREAS:	
Wings, gross: VLA	5.20 m² (56.0 sq ft)
Club	6.45 m² (69.4 sq ft)
ULM, M	8.31 m² (89.4 sq ft)
Motor Glider	9.35 m² (100.6 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped: VLA	235 kg (518 lb)
Club	245 kg (540 lb)
ULM, M	250 kg (551 lb)
Motor Glider	262 kg (578 lb)
Baggage capacity	15 kg (33 lb)
Max T-O weight: VLA, ULM	450 kg (992 lb)
Club	490 kg (1,080 lb)
M	544 kg (1,199 lb)
PERFORMANCE (59.7 kW; 80 hp engine):	
Never-exceed speed (VNE):	
normal: VLA	172 kt (320 km/h; 198 mph)
Club, ULM	162 kt (300 km/h; 186 mph)
M	170 kt (315 km/h; 195 mph)
with BRS: all	145 kt (270 km/h; 167 mph)
Max level speed: VLA 912	163 kt (302 km/h; 188 mph)
VLA 914	197 kt (364 km/h; 226 mph)
Club	151 kt (281 km/h; 174 mph)
ULM	150 kt (278 km/h; 172 mph)
Motor Glider	135 kt (250 km/h; 155 mph)
Max cruising speed at 75% power:	
at FL80:	
VLA 912	158 kt (292 km/h; 181 mph)
Club	150 kt (278 km/h; 173 mph)
ULM	146 kt (270 km/h; 168 mph)
Motor Glider	130 kt (240 km/h; 149 mph)
M	119 kt (221 km/h; 137 mph)
at FL110:	
VLA 914	154 kt (286 km/h; 178 mph)
ULM	143 kt (265 km/h; 165 mph)
Stalling speed, flaps down:	
VLA	50 kt (91 km/h; 57 mph)
Club	43 kt (79 km/h; 49 mph)
ULM	34 kt (63 km/h; 40 mph)
Motor Glider	30 kt (55 km/h; 35 mph)
M	38 kt (70 km/h; 44 mph)
Max rate of climb at S/L: Sportster, Club	609 m (2,000 ft)/min
ULM	426 m (1,400 ft)/min
T-O run: VLA	285 m (935 ft)
Club	210 m (689 ft)
ULM	195 m (640 ft)
T-O to 15 m (50 ft): VLA, Club	424 m (1,395 ft)
ULM	203 m (666 ft)
Range at econ cruising speed and altitude:	
with normal fuel: VLA	894 n miles (1,657 km; 1,029 miles)
Club	829 n miles (1,536 km; 954 miles)
ULM	834 n miles (1,545 km; 960 miles)
with max optional fuel:	
VLA	3,452 n miles (6,394 km; 3,973 miles)
Club	1,623 n miles (3,006 km; 1,867 miles)
ULM	1,611 n miles (2,985 km; 1,854 miles)
g limits: all except VLA	+4/-2
VLA	+3.8/-1.9

DYN'AERO MCR4S

TYPE: Four-seat kitbuilt.
PROGRAMME: Mockup first shown at Aero '99, Friedrichshafen, April 1999. Kits available from late 1999. Prototype (F-WWUZ) first flew 14 June 2000 and displayed at PFA International Air Rally, Cranfield, UK, 23-25 June 2000. First customer aircraft, built by noted French light aircraft designer/manufacturer Pierre Robin, flew in mid-2001 and DGAC certification achieved 26 June 2001. PFA approval was being sought in mid-2003 and was expected during 2005.



Dyn'Aéro MCR4S (Paul Jackson)

1159342

CURRENT VERSIONS: **MCR2S Ibis:** Two-seat version with generous baggage space; marketed by Italian agents, Aerodream Group SRL of Voghera Rivanazzano (www.aerodream.net) and approved for local Ultralight category.

Three-seat: With 59.6 kW (79.9 hp) Rotax 912 UL or JPX 4TX75 engine; 640 kg (1,411 lb) MTOW.

Four-seat: With 73.5 kW (98.6 hp) Rotax 912 UL-S normally aspirated engine and MT-Propeller MTV-7-A/156-122 fixed-pitch propeller; 750 kg (1,653 lb) MTOW.

Four-seat Performance: 84.6 kW (113.4 hp) Rotax 914 UL turbocharged engine and constant-speed propeller, optimised for cruise at 3,050 m (10,000 ft).

CITEC: On 29 July 2001, Dyn'Aéro and Wilksch Airmotive of the UK announced a joint programme to develop the MCR4S CITEC, powered by the Wilksch WAM-120 diesel engine. Launch customer for this version was M. Serge Blanchard.

CUSTOMERS: Total 71 kits sold by July 2006, of which 36 were then flying in France alone. **COSTS:** Kit EUR48,100, less engine; EUR86,600, EUR91,900 or EUR131,700 with Rotax 912 ULS plus three-blade fixed-pitch propeller, 912 ULS plus constant-speed two-blade MT propeller or 914 plus two-blade constant-speed propeller (2003).

DESIGN FEATURES: Three/Four-seat version of MCR01, having 75 per cent commonality. Dihedral 3°. Winglets introduced in 2001, and modified in 2002.

Description generally as for MCR01, except that below.

FLYING CONTROLS: Ailerons, plus two-segment flaps. Aileron max deflection -20°/+10°. Tailplane (all moving) max deflection +3.5°/-10°. Rudder deflection ±20°. Double-slotted flaps, deflections 0, 17 and 30°.

LANDING GEAR: Tricycle type; fixed. Wing-mounted, trussered, cantilever main legs with integral shock-absorbers. Fairing on all three wheels.

POWER PLANT: See Current Versions. Fuel in two wing tanks; standard capacity 130 litres (34.3 US gallons; 28.6 Imp gallons); optionally two 100 litre (26.4 US gallon; 22.0 Imp gallon) tanks can be fitted. In both cases, 2 litres (0.5 US gallons; 0.4 Imp gallons) is unusable.

ACCOMMODATION: Four persons, in two side-by-side pairs. Forward-hinged, two-piece canopy/windscreen, plus two fixed side windows.

EQUIPMENT: Ballistic parachute optional.

DIMENSIONS, EXTERNAL:

Wing span	8.72 m (28 ft 7¼ in)
Wing chord (constant)	0.96 m (3 ft 1¾ in)
Wing aspect ratio	9.2
Length overall	6.70 m (21 ft 11¼ in)
Height overall	1.90 m (6 ft 2¾ in)
Tailplane span	2.50 m (8 ft 2½ in)
Wheel track	2.33 m (7 ft 7¾ in)
Propeller max diameter: two blade	1.70 m (5 ft 7 in)
three-blade	1.56 m (5 ft 1½ in)

DIMENSIONS, INTERNAL:

Cabin max width	1.20 m (3 ft 11¼ in)
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AREAS:

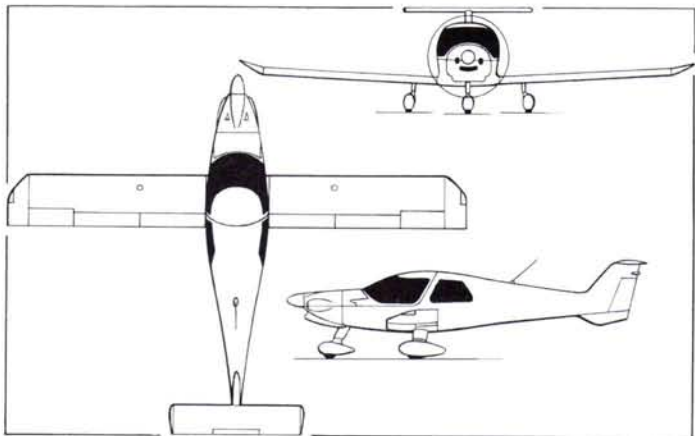
Wings, gross	8.30 m² (89.3 sq ft)
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WEIGHTS AND LOADINGS:

Weight: empty	300 kg (661 lb)
equipped	350 kg (772 lb)
Baggage capacity	40 kg (88 lb)
Max T-O weight	640-750 kg (1,411-1,653 lb)

PERFORMANCE (Rotax 912, 912 ULS and 914 UL engines):

Never-exceed speed (VNE)	145 kt (270 km/h; 167 mph)
Max level speed: 912	143 kt (265 km/h; 165 mph)
912 ULS	156 kt (288 km/h; 179 mph)
914 UL	173 kt (320 km/h; 199 mph)
Manoeuvring speed	118 kt (219 km/h; 136 mph)
Max cruising speed: 912	136 kt (252 km/h; 157 mph)
912 ULS	150 kt (277 km/h; 172 mph)
914 UL	155 kt (287 km/h; 178 mph)
Econ cruising speed: 912	127 kt (236 km/h; 147 mph)
912 ULS, 914 UL	147 kt (272 km/h; 169 mph)



Dyn'Aéro MCR4S three/four-seat tourer with current wingtip configuration (Paul Jackson)

1159377

Stalling speed: flaps up	54 kt (100 km/h; 63 mph)
flaps down	45 kt (83 km/h; 52 mph)
Max rate of climb at S/L: 912	228 m (750 ft)/min
914UL	274 m (900 ft)/min
T-O run with c/s prop: 912	350 m (1,148 ft)
912 ULS	203 m (670 ft)
914 UL	153 m (505 ft)

T-O to 15 m (50 ft) with c/s prop: 912	455 m (1,495 ft)
912 ULS	295 m (970 ft)
914 UL	221 m (725 ft)
Landing run with c/s prop: 912 ULS	201 m (660 ft)
Range with max fuel:	996 n miles (1,846 km; 1,147 miles)
g limits	+3.8/-1.5

ESPACE LIBERTE

ESPACE LIBERTÉ SARL

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DIRECTOR: Charles Guérin

Having worked on design of the DEA Yuma STOL lightplane in Italy, Charles Guérin returned to France to pursue development of a modified version, incorporating refinements including the option of three stages of high-lift wing. However, the company was placed in receivership on 6 December 2005; it became G1 Aviation in March 2006; promotion of the aircraft continues with the new company.

EURO PINGOUIN

EURO PINGOUIN TEAM

Les Guérins, F-05130 Sigoyer

Tel: (+33 6) 81 01 38 76

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Web: www.pingouin152.com

DIRECTOR: J B Bonnet

Based at Gap-Tallard aerodrome, Euro Pingouin was established to market a European version of a South American ultralight based on a North American lightplane.

EURO PINGOUIN 152

TYPE: Side-by-side ultralight kitbuilt.

PROGRAMME: Prototype conceived and built in South America. Acquired by French company and re-engineered for European market. Parts fabricated in Eastern Europe; assembly centres sought for flyaway version.

COSTS: Kit EUR47,000 including engine, or EUR34,000 excluding engine, plus tax (2006).

DESIGN FEATURES: General appearance based on Cessna 152. High, constant-chord wing with single, streamlined bracing strut each side. Low tailplane and sweptback fin, mutually rod-braced. Quoted build time 100 to 150 hours.

FLYING CONTROLS: Conventional and manual. Flaps; max deflection 40°. Flaps and elevator trim electrically actuated.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring cantilever mainwheel legs; cantilever nosewheel leg. Mainwheel disc brakes.

POWER PLANT: One Rotax flat-four piston engine driving an Ivoprop three-blade, constant-speed propeller; option of 58.8 kW (78.9 hp) 912 UL or 73.5 kW (98.6 hp) 912 ULS. Fuel capacity 90 litres (23.8 US gallons; 19.8 Imp gallons).

EQUIPMENT: Optional ballistic recovery parachute.

DIMENSIONS, EXTERNAL:

Wing span

Length overall

Height overall

DIMENSIONS, INTERNAL:

Cabin max width

AREAS:

Wings, gross

WEIGHTS AND LOADINGS:

Weight empty

T-O weight: without parachute

with parachute

PERFORMANCE (Rotax 912 UL):

Max level speed

Stalling speed, flaps down

Max rate of climb at S/L

T-O run

Landing run



Euro Pingouin 152 two-seat ultralight variant on a Cessna theme (R W Simpson)

1158848

G1 AVIATION

G1 AVIATION

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Tel: (+33 2) 35 59 08 62

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e-mail: julie.guerin@g1aviation.com

Web: www.g1aviation.com

DIRECTOR: Charles Guérin

Former Espace Liberté became G1 Aviation in March 2006 and continued with promotion and production of the G1 lightplane. Flight testing and distribution is undertaken at Aérodrôme Gap-Tallard.

G1 AVIATION G1

TYPE: Side-by-side ultralight/kitbuilt.

PROGRAMME: Development began 1994 as DEA Yuma. Adaptations of design, leading to G1, began in 2002; several trials aircraft. Series production aircraft '00' shown at Aero '03, Friedrichshafen, in April 2003; No. 01 then intended to fly by mid-2003. Progress apparently overtaken by company being placed in receivership on 5 December 2005.

CUSTOMERS: Total of 15 flying plus 10 more under construction, by April 2005.

COSTS: V3 EUR53,435; V2 EUR51,145; V1 EUR46,295; all plus tax (2004).

DESIGN FEATURES: Objectives included better performance than existing STOL light aircraft, but without sacrifice of cruising speed; effective and harmonised controls; foldable wings. Aircraft can be folded for transport by one person in 10 minutes.

High wings with V-struts; sweptback fin with ventral fillet. Quoted build time (optional kit) 250 hours.



G1 Aviation G1 with starboard wing folded (Paul Jackson)

1121770

FLYING CONTROLS: Conventional and manual. Large, cable-actuated control surfaces for effectiveness of response at slow speeds. Slats on wing leading edge; trailing-edge electrically-operated plain flaps.

STRUCTURE: Generally of heat-treated and corrosion-proofed aluminium alloy; skins bonded before riveting. Welded tubular 4130 steel frame cockpit structure; steel alloy wing struts. Control surfaces covered in Dacron fabric. Wing leading-edge slats of carbon fibre. Composites tips to wing and empennage. Composites engine cowlings. Lexan windscreen; polycarbonate side windows.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted aluminium spring cantilever mainwheel legs with optional wheel fairings. Steerable, telescoping nosewheel leg. Mainwheels 8.00-6 (optionally larger); nosewheel 15x6.00-6. Hydraulic disc brakes. Mainwheel and parking brakes. Optional floats and skis.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS flat-four. Fuel in wing tanks and header tank, total capacity 84 litres (22.2 US gallons; 18.5 Imp gallons). Duc Tripale Swirl three-blade, carbon fibre propeller, ground- or flight-adjustable.

EQUIPMENT: Ballistic parachute. Optional agricultural spraying equipment.

DIMENSIONS, EXTERNAL:

Wing span	9.91 m (32 ft 6 1/4 in)
Length overall	6.73 m (22 ft 1 in)
Height overall	2.34 m (7 ft 8 1/4 in)

DIMENSIONS, INTERNAL:

Cabin max width	1.20 m (3 ft 11 1/4 in)
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AREAS:

Wings, gross	14.76 m ² (158.9 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty (incl parachute)	290 kg (639 lb)
Max T-O weight	450 kg (992 lb)

PERFORMANCE:

Never-exceed speed (VNE)	118 kt (220 km/h; 136 mph)
Cruising speed at 75% power	84 kt (155 km/h; 96 mph)
Stalling speed, power off, flaps down	27 kt (50 km/h; 31 mph)
Max rate of climb at S/L	457 m (1,500 ft)/min
T-O run	50 m (165 ft)
Landing run	60 m (200 ft)
Range	324 n miles (600 km; 372 miles)
g limits	+4/-3

GUIMBAL

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DIRECTOR: Bruno Guimbal

While working as head of research for Eurocopter at Marignane Bruno Guimbal designed, built and flew a prototype of the Cabri G2 light helicopter, receiving some sponsorship from his company for final preparation and flight testing. The programme lapsed in the mid-1990s, but M Guimbal left Eurocopter on 1 October 2000 and formed Hélicoptères Guimbal to continue the project and by the following year had eight employees at Aix-les-Milles aerodrome. This had increased to 30 by 2005, when 40 industrial partners were collaborating on the re-launched project. Certification target of late 2005 was not achieved.

At Paris Air Show in June 2005, Eurocopter and Hélicoptères Guimbal signed an agreement for the creation of Vertivision company to develop, market, manufacture and support helicopter UAVs with military applications.



Second prototype Guimbal Cabri G2 light helicopter (André Tarditi, Guimbal)

1133982

GUIMBAL G2 CABRI

TYPE: Two-seat helicopter.

PROGRAMME: Privately designed and developed during the late 1980s; first flight (F-PILA) at Marignane 11 April 1992; flight testing continued privately at Aix en Provence.

On 21 May 1996, M Guimbal broke the FAI E-1a category record for distance flown by a helicopter under 500 kg by covering the 259.9 n miles (481.32 km; 299.1 miles) from Paris to Valence without landing or refuelling. Flew 150 hours between 1992 and 1998.

At Paris in June 2003, Eurocopter announced selection of Cabri G2 as basis for its Orka 1200 UAV. The vehicle is contesting a requirement sponsored by France's DGA armaments agency for a UAV (Devin — *drone à envol vertical interarmées*) to be operated by both the army and navy from 2012-13 onwards.

Second prototype (F-WYHG) flew at Aix on 31 March 2005, exhibiting several external refinements, including revised door transparencies; raised horizontal stabiliser; and modified fin/underfin shapes. Established records for helicopters under 500 kg at Rouen on 21 August 2005 during public debut at World Helicopter Championship: height of 6,656 m (21,837 ft) and 6 min 42 s to height of 3,000 m (9,840 ft).

Certification to EASA/FAR Pt 27 was due in late 2005, followed by deliveries from 2006 onwards. However, up to June 2006, neither event had taken place and the company had not published a revised specification for the latest version, the data following being largely based on the original machine.

DESIGN FEATURES: Intended to compete with Robinson R22, but promotion was initially deterred by high number of accidents then in private light helicopter sphere. Current design includes safety features including crash-resistant seats and fuel system.

Three-blade rotor, moderate control power (apparent hinge offset 4.8 per cent) and fail-safe design; design avoids mast bumping, minimises dynamic roll-over or over-control and allows wide CG travel; rotor inertia lies between that of Bell JetRanger and Bell 47 to give best practical autorotation performance; Spheriflex main rotor hub, with forked blade-ends picking up single elastomeric centrifugal bearings and mast-mounted droop stops, designed for low maintenance; drag dampers and simple elastomeric; patented driveshaft runs in an oblique groove in top of tail pylon; bearingless seven-blade Fenestron tail rotor has Kevlar starplate hub giving integral pitch change freedom and offers good control with protection from contact with long grass and harder obstacles; tailplane has lifting aerofoil designed to unload Fenestron in cruising flight and save power. Industrial participants include SNR for bearings; Sauter & Bachmann gears; Manoir forgings; SEFEE wiring looms; SARMA, CBA and Jacottet controls; Lourd rotor laminations; Zodiac-Aérazur fuel tanks; EADS-Composites Aquitaine central structures; ATN International rear structure; and Vega Industries electrical system. Main rotor rpm 597; Fenestron rpm 5,734.

FLYING CONTROLS: Unboosted mechanical dual control with friction damper at base of cyclic stick acting as attitude trim.

STRUCTURE: Carbon-epoxy airframe shell weighs 70 kg (154.3 lb), accounting for 22 per cent of empty weight; based on central box of GFRP sandwich carrying instrument console, two integral fuel tanks, transmission, landing skids, engine and tailboom; lateral shells contain seats, windows and pylon fairing; GFRP tailboom, Fenestron and fin integral, but detachable from fuselage.

LANDING GEAR: Two fixed aluminium skids high energy-absorption landing gear bows of filament-wound R-glassfibre giving 4 m (13.12 ft)/s impact absorption.

POWER PLANT: One 112 kW (150 shp) Textron Lycoming O-320 flat-four engine, mounted horizontally, nose forward, with 4 into 1 straight exhaust to reduce engine noise; downdraught cooling fan, fed by ram intake in pylon fairing and mounted on alternator on top of engine, driven through 90° by belt from crankshaft; engine drives transmission by four-sheave V-belt with reduction ratio 0.91:1; belt tensioned by rotating pulley bearing by eccentric lever driven by small electric actuator; main driveshaft drives Fenestron and main transmission; reductions by simple spiral bevel gears (4:1 for main rotor and 1:2.5 for Fenestron); rotor pylon is stationary with splined driveshaft inside. Fuel capacity 154 litres (40.7 US gallons; 33.9 Imp gallons) in two interconnected integral tanks with single filler cap.

DIMENSIONS, EXTERNAL:

Main rotor diameter	6.50 m (21 ft 4 in)
Main rotor blade chord	0.16 m (6.3 in)
Fenestron diameter	0.54 m (1 ft 9 1/4 in)
Fenestron blade chord	0.038 m (1 1/2 in)
Length overall	5.75 m (18 ft 10 1/2 in)
Fuselage max width	1.18 m (3 ft 10 1/2 in)
Height to top of rotor head	2.10 m (6 ft 10 3/4 in)

DIMENSIONS, INTERNAL:

Baggage volume	0.18 m ³ (6.35 cu ft)
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AREAS:

Main rotor disc	33.18 m ² (357.2 sq ft)
Fenestron disc	0.23 m ² (2.47 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	320 kg (705.5 lb)
Max T-O weight	550 kg (1,212 lb)
Max disc loading	16.58 kg/m ² (3.39 lb/sq ft)
Max power loading	4.92 kg/kW (8.08 lb/hp)

PERFORMANCE (calculated):

Max level speed, 75% power:	108 kt (200 km/h; 124 mph)
Cruising speed	97 kt (180 km/h; 112 mph)
Service ceiling	2,200 m (7,215 ft)
Range	539 n miles (1,000 km; 621 miles)
Endurance	5 h

HUMBERT

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Web: www.humbert-aviation.com
DESIGNER: Jean-Jacques Humbert

Formed by Jacques Humbert in 1984, the company's most recent design is the Tétrás, although the earlier Moto du Ciel remains available.

HUMBERT TETRAS

TYPE: Side-by-side ultralight/kitbuilt.
PROGRAMME: Prototype unveiled at 1992 RSA Rally at Moulins. Named for a fish of the genus *Characidae*. Marketing began in 1994.
CURRENT VERSIONS: **Tétrás B**: Standard version with HW2000 or Rotax 912 UL engine; as described.
Tétrás BS: Higher-powered version with Rotax 912 ULS engine.
CUSTOMERS: At least 10 on French ultralight register by December 2001; one further by July 2006. Has also been evaluated by Centre d'Essais en Vol (CEV) for possible military applications, and supplied to Niger for insecticide spraying.
COSTS: Kit, with Rotax 912 UL engine, EUR15,000; flyaway EUR31,500 (2001).
DESIGN FEATURES: High wing with single bracing strut on each side; strut-braced tailplane. Wing section NACA 23012. Quoted build time 150 to 250 hours.
FLYING CONTROLS: Conventional and manual. Three-position plain flaps, deflections 0, 15 and 45°.
STRUCTURE: Steel tube fuselage with Dacron covering; composites wing; light alloy ailerons and flaps.
LANDING GEAR: Tailwheel type; fixed. Two faired-in side Vs hinged to lower longerons, plus half-axes sprung under centreline with bungee cord and attached to compression frame.
POWER PLANT: One 53.7 kW (72 hp) Humbert-Volkswagen HW 2000 or 59.6 kW (79.9 hp) Rotax 912 UL flat-four, driving a two-blade DUC FC composites propeller. Other options



Humbert Tétrás two-seat ultralight (Pierre Gaillard) 1159269

available, including JPX engine and 73.4 kW (98.4 hp) Rotax 912 ULS. Fuel in two wing tanks, combined capacity 60 litres (15.9 US gallons; 13.2 Imp gallons); can be increased to 85 litres (22.5 US gallons; 18.7 Imp gallons) for aircraft in countries other than France.
EQUIPMENT: Spray system optional.
DIMENSIONS, EXTERNAL:
Wing span 10.10 m (33 ft 1¾ in)
Length overall 6.50 m (21 ft 4 in)
Height overall 2.06 m (6 ft 9 in)
Propeller diameter 1.71 m (5 ft 7¼ in)
AREAS:
Wings, gross 15.70 m² (169.0 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 277 kg (611 lb)
Max T-O weight 450 kg (992 lb)
PERFORMANCE (Rotax 912 UL):
Max level speed 105 kt (194 km/h; 121 mph)
Cruising speed at 75% power at FL100 101 kt (187 km/h; 116 mph)
Stalling speed, flaps down 30 kt (55 km/h; 35 mph)
Max rate of climb at S/L 381 m (1,250 ft)/min
T-O run 50–80 m (164–262 ft)
g limits +4/-2

ISSOIRE

ISSOIRE AVIATION
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Web: www.apm20lionceau.com
PRESIDENT AND CEO: Philippe Moniot
DIRECTOR: Laurent Bourdier
SALES MANAGER: Yves Moyné-Bressand
INFORMATION CONTACT: Isabelle Moniot

Issoire Aviation was established in 1978 as a successor to Wassmer Aviation and its CERVA lightplane division. A subsidiary, Rex Composites, is responsible for carbon fibre airframes including that of Sagem Sperwer UAV. Current product is the APM-20/30 lightplane, which is in very low-rate production. An unmanned version is planned.

ISSOIRE APM-20 LIONCEAU AND APM-30 LION

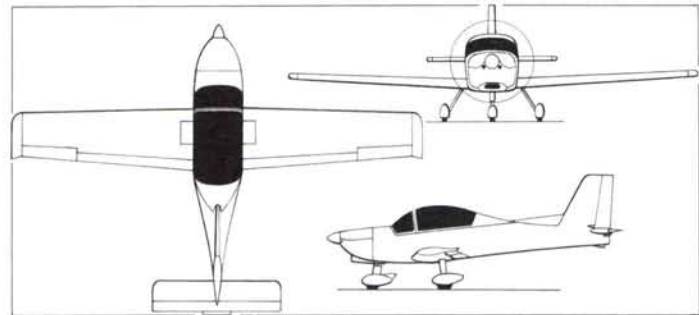
English name: **Lion Cub**
TYPE: Two-seat lightplane; three-seat lightplane.
PROGRAMME: Design (as Moniot APM-20) started 1992 by Les Industries de Composites d'Auvergne Réunites (ICAR); prototype (F-WWMP) exhibited at Paris Air Show 1995 before first flight on 21 November 1995; third (second flying) aircraft (F-WWXX) exhibited statically at Paris Air Show, June 1997, fitted with JPX flat-four engine, which is not offered on production aircraft. No. 4 (also F-WWXX) exhibited at Paris in June 1999 and No. 5 (F-GRRE) in 2001. Certified to JAR-VLA 17 May 1999 and to JAR-21 in 2000. First all-carbon fibre, single-engine aircraft to gain JAR-VLA certification. APM-21 will follow at unspecified date. Tailwheel and diesel-engined variants were under consideration in early 2003.
CURRENT VERSIONS: **APM-20**: Primary trainer As described.
APM-21 Lion: Aerial work version powered by 73.5 kW (98.6 hp) Rotax 912 ULS engine driving a two-blade, constant-speed Hoffmann propeller. Fitted with winglets. Prototype (F-WWMP, modified from prototype Lionceau) demonstrated at Paris Air Show in June 1999. Development halted in favour of APM-30.
APM-22 Liondo: Prototype APM-21 equipped with large winglets and exhibited at Paris, 15–22 June 2003, as representative of this UAV proposal, with 24-hour endurance and 556 kg (1,225 lb) MTOW.
APM-30 Lion: Three-seat version; EASA certification due 2006 for night VFR. Prototype F-WWXX first flew 2 June 2005 and made public debut at the Paris Air Show, 13 June
CUSTOMERS: Three flying prototypes; one static test airframe (No. 02). Total of 12 production aircraft registered by late 2005. Break-even point estimated at 200 aircraft.



Prototype Issoire APM-30 Lion (Paul Jackson) 1153795

COSTS: EUR110,000 APM-20; EUR130,000 APM-30; both including tax (2005).
DESIGN FEATURES: Low wing, NACA 63418 aerofoil, thickness/chord ratio 18 per cent, dihedral 3°, incidence 1°30', twist 1°.
FLYING CONTROLS: Conventional and manual. Ailerons maximum deflections +15/-25°; horizontal tail surface aerofoil section Wortmann E10; fin/rudder aerofoil section NACA 64020 at root, NACA 64015 at tip; rudder maximum deflection +/-25°; spring elevator tab for pitch trim. Electrically operated slotted flaps to about two-thirds span, maximum deflection 25°.
STRUCTURE: Carbon fibre/epoxy; two-spar wing.
LANDING GEAR: Fixed tricycle type, with wheel fairings. Fuselage-mounted GFRP cantilever mainwheel legs with steerable oleo-sprung nosewheel. Mainwheels and nosewheel size 330 x 130; maximum pressure 2.35 bar (34 lb/sq in).
POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912A (APM-20) or 73.5 kW (98.6 hp) Rotax 912S (APM-30) four-cylinder four-stroke driving an Evra AL1 two-blade, fixed-pitch wooden propeller. Fuel capacity 68 litres (18.0 US gallons; 15.0 Imp gallons), of which 65 litres (17.2 US gallons; 14.3 Imp gallons) are usable. Refuelling point on port side of fuselage. Oil capacity 4 litres (1.1 US gallons; 0.9 Imp gallon).
ACCOMMODATION: Two, side by side under rearward-sliding tinted canopy; third seat at rear in APM-30. Dual controls (sticks) and four-point harnesses standard. Baggage compartment at rear of seats in APM-20. Fixed step forward of wing leading-edge on each side.
AVIONICS: Instrumentation: VFR panel standard.

DIMENSIONS, EXTERNAL:
Wing span 8.66 m (28 ft 5 in)
Wing chord: at root 1.10 m (3 ft 7¼ in)
at tip 0.84 m (2 ft 9 in)
Wing aspect ratio 7.9
Length overall 6.60 m (21 ft 7¾ in)
Max width of fuselage 1.15 m (3 ft 9¼ in)
Height overall 2.40 m (7 ft 10½ in)
Tailplane span 2.68 m (8 ft 9¾ in)
Wheel track 1.80 m (5 ft 10¾ in)
Propeller diameter 1.64 m (5 ft 4½ in)
Propeller ground clearance 0.31 m (1 ft 0¼ in)
DIMENSIONS, INTERNAL:
Cabin max width 1.06 m (3 ft 5¾ in)



APM-20 Lionceau (Rotax 912A engine) (James Goulding) 0064443

AREAS:	
Wings, gross	9.50 m ² (102.3 sq ft)
Ailerons (total)	0.52 m ² (5.60 sq ft)
Trailing-edge flaps (total)	1.36 m ² (14.64 sq ft)
Fin	0.85 m ² (9.15 sq ft)
Rudder	0.26 m ² (2.80 sq ft)
Tailplane	1.74 m ² (18.73 sq ft)
Elevator, incl tab	0.50 m ² (5.38 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty: APM-20	380 kg (838 lb)
APM-30	418 kg (922 lb)
Baggage capacity	20 kg (44 lb)
Max fuel	49 kg (108 lb)
Max T-O weight:	
APM-20	634 kg (1,397 lb)
APM-30	708 kg (1,560 lb)

Max wing loading	65.3 kg/m ² (13.37 lb/sq ft)
Max power loading	10.39 kg/kW (17.06 lb/hp)
PERFORMANCE (APM-20/30, except as stated):	
Never-exceed speed (VNE)	135 kt (250 km/h; 155 mph)
Max cruising speed at FL55: APM-20	124 kt (230 km/h; 143 mph)
APM-30	130 kt (241 km/h; 150 mph)
Econ cruising speed: APM-20	95 kt (176 km/h; 109 mph)
APM-30	100 kt (185 km/h; 115 mph)
Manoeuvring speed	108 kt (200 km/h; 124 mph)
Stalling speed: flaps up	56 kt (104 km/h; 65 mph)
flaps down: APM-20	44 kt (80 km/h; 50 mph)
APM-30	45 kt (84 km/h; 52 mph)
Max rate of climb at S/L	192 m (630 ft)/min
T-O to 15 m (50 ft)	499 m (1,640 ft)
Landing from 15 m (50 ft)	468 m (1,535 ft)
Endurance	4 h

KIEGER

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Web: www.junkersprofly.free.fr

M Kieger has been responsible for the design and construction of three low-wing, two-seat light aircraft, including the AK-01T of 1989 (F-PZMO, a tailwheel variant) and AK-2R, produced in 1998. The latter (F-PARJ) has now flown more than 1,200 hours as a tug at the Haguenau gliding club while a second example of the former (F-PAKT, tricycle landing gear) has been used by the Haguenau flying club since 2001.

KIEGER AK3

TYPE: Side-by-side ultralight.
PROGRAMME: Prototype (67-AAK, F-ZJTZ) had flown 10 hours up to time of public launch at Blois RSA meeting, August 2006. Series manufacture then scheduled to begin by Junkers in September 2006 at three per month.
COSTS: EUR59,800 plus tax (2006).
DESIGN FEATURES: Low-mounted wing and tailplane; sweptback fin; rectangular section lower fuselage; ovoid upper surface.
FLYING CONTROLS: Conventional and manual. Horn balances on rudder and elevators. Flaps.
STRUCTURE: Fuselage built on four longerons; plywood covering. Single-spar wing attached to fuselage by four steel (sailplane type) pins to facilitate rapid removal for storage; leading edge of plywood; false spar mounts control surfaces. Plywood empennage. Carbon fibre engine cowling.



Kieger (Junkers Profly) AK3 ultralight 1158655

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring glass/carbon fibre laminate cantilever mainwheel legs; trailing link nosewheel on forward-raked cantilever leg. Hydraulic disc brakes on mainwheels. Wheel fairings.
POWER PLANT: One 58.8 kW (78.9 hp) Rotax 912 UL flat-four driving a Duc Swirl three-blade propeller. Fuel tank in fuselage, capacity 60 litres (15.9 US gallons; 13.2 Imp gallons); optional wing fuel tanks, combined capacity 70 litres (18.5 US gallons; 15.4 Imp gallons).
DIMENSIONS, EXTERNAL:
Wing span 8.00 m (26 ft 3 in)
Length overall 6.15 m (20 ft 2¼ in)
DIMENSIONS, INTERNAL:
Cockpit max width 1.13 m (3 ft 8½ in)
AREAS:
Wings, gross 10.40 m² (111.9 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 288 kg (635 lb)
Max T-O weight 472.5 kg (1,041 lb)
PERFORMANCE:
Max level speed 124 kt (230 km/h; 143 mph)
Normal cruising speed 108 kt (200 km/h; 124 mph)
Stalling speed, flaps down 34 kt (63 km/h; 40 mph)
T-O and landing run 100 m (330 ft)

LH
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DIRECTOR: Sébastien Lefebvre
ENGINEERS:

Matthieu Founi
Matthieu Billet

Sébastien Lefebvre and Frédéric Hubschwerlen formed LH Aviation in May 2004 to market the LH-10 Ellipse, an aircraft they designed themselves. International marketing began at Aero '05, Friedrichshafen, April 2005. In early 2007, the company had six employees.

LH-10 ELLIPSE

TYPE: Tandem-seat kitbuilt.
PROGRAMME: Design began June 2003; prototype construction started September 2003; announced at AviaExpo, Lyon, France, 18 June 2004, when a full-scale fuselage mockup was displayed. By late 2005 the prototype had been fitted with wings and landing gear, making first engine run on 30 December that year. First flight (F-WWMV) 10 November 2006. Investigation was under way in 2005 of Microjet Engineering's 97.0 kW (130 shp) HPX650 turboprop as a possible power plant.



Taxying trials of LH Aviation LH-10 Ellipse 1209323

DESIGN FEATURES: Objectives included wide speed range, permitting long-range travel at 200 kt (370 km/h; 230 mph) or pleasure flying at 100 kt (185 km/h; 115 mph) using only 5 litres (1.3 US gallons; 1.1 Imp gallons) per hour; operation from small airfields through use of high-lift devices; and large and comfortable cockpit.

Mid-mounted engine and pusher propeller; high aspect ratio wings with thickened root gloves; broad underfin; extended wheelbase achieved by forward-raked nosewheel; dual sidestick controls. Designed to FAR Pt 23 criteria.

Marketed as quick-build kit, with most composites structural parts bonded and ready for assembly. Builder assistance programme available.

FLYING CONTROLS: Manual. Full-span flaperons; horn-balanced rudder; all-moving tailplane. STRUCTURE: Generally of composites.

LANDING GEAR: Tricycle type; fixed main gear and hydraulically-retractable castoring nosewheel. Rubber-in-compression shock-absorber on main legs; cantilever sprung nosewheel.

POWER PLANT: One 70.8 kW (95 hp) UL Power UL 260i flat-four piston engine in mid-fuselage, driving a three-blade, ground-adjustable pitch, pusher propeller via a carbon fibre drive shaft. Fuel capacity 70 litres (18.5 US gallons; 15.4 Imp gallons).

ACCOMMODATION: Two in tandem, under separate, single-piece canopies, front also as windscreen. Dual controls including sidesticks.

DIMENSIONS, EXTERNAL:

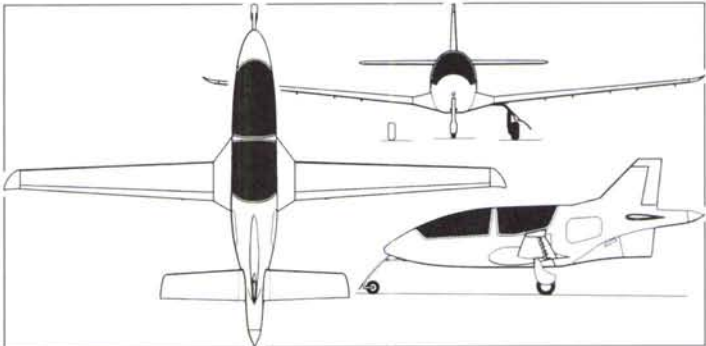
Wing span	8.00 m (26 ft 3 in)
Wing aspect ratio	14.2
Length overall	5.11 m (16 ft 9¼ in)
Height overall	2.14 m (7 ft 0¼ in)

DIMENSIONS, INTERNAL:

Cockpit max width	0.68 m (2 ft 2¾ in)
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AREAS:

Wings, gross	4.50 m ² (48.4 sq ft)
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LH Aviation LH-10 Ellipse two-seat, high-performance kitbuilt (Paul Jackson) 1158957

WEIGHTS AND LOADINGS:

Weight empty	250 kg (551 lb)
Max T-O weight	490 kg (1,080 lb)

PERFORMANCE (estimated):

Never-exceed speed (VNE)	270 kt (500 km/h; 310 mph)
Max level speed	200 kt (370 km/h; 230 mph)
Cruising speed at 75% power	100 kt (185 km/h; 115 mph)
Stalling speed	53 kt (99 km/h; 61 mph)
T-O to 15 m (50 ft)	259 m (850 ft)
Landing from 15 m (50 ft)	259 m (850 ft)
g limits	+4.4/-2.2

LIFTIUM

LIFTIUM SA
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Tel: (+33 1) 47 04 30 93
e-mail: didiercostes@wanadoo.fr
Web: www.perso-wanadoo.fr/liftium/liftium
MANAGING DIRECTOR: Gérard Didier Costes
PILOT: Thierry Garçon

Liftium's founder, Gérard Didier Costes, was a member in 1990–92 of a team which developed a human-powered airship known as the Zeppy-2 Continent. His Liftium is an unusual design of airship which is intended to become a family ranging in size from 250 to 6,000 m³ (8,830 to 211,900 cu ft), with even larger freight versions.

LIFTIUM LIFTIUM SERIES

TYPE: Helium semi-rigid airship.

PROGRAMME: First flight 7 November 2002 at Calvi, Corsica, by Liftium-1 prototype (W-91RG); later designated Model 250. This demonstrated excellent manoeuvrability and ease of piloting, but envelope fabric was poorly resistant to tearing; improved versions will utilise stronger fabric, while retaining power plant, tail surfaces, landing gear and other aspects of Liftium-1.

CURRENT VERSIONS: **Liftium 250:** Two-seat open cockpit ultralight version. Volume 250.0 m³ (8,830 cu ft). *As described.*

Liftium 500: Second stage development. Tandem seats in enclosed gondola; ultralight; volume 500.0 m³ (17,660 cu ft); suitable for sporting, patrol and training duties.

Liftium 1000: Four-seat version. Volume 1,000 m³ (35,315 cu ft); ultralight.

Liftium 6000: Capacity 20 passengers in side-by-side pairs. Volume 6,000 m³ (211,900 cu ft).

Liftium Fret 20T: Length 95 m (312 ft). Suspended load 20 tonnes. Rear engines augmented by horizontal sustaining rotors each side of gondola to provide additional lift.



Prototype Liftium-1 (Model 250) 1112130

Liftium Fret 35T: Length 125 m (410 ft). Suspended load 35 tonnes; two sustaining rotors.

Liftium Fret 300T: Length not given. Suspended load 300 tonnes; four sustaining rotors.

DESIGN FEATURES: 'Envelope' is in the form of a *flechette*, or dart, consisting of three inflated lobes of narrow delta planform, arranged in inverted Y configuration and powered by a pusher engine. Four-lobe version also possible.

FLYING CONTROLS: Elevator/rudder on each trailing-edge. Pitch equilibrium is maintained by transfer of water ballast between bow and stern.

STRUCTURE: Triple-lobe, dart-shaped envelope, with lower supplementary lobe above ventrally suspended gondola. Elastic ties permit variations in volume, obviating need for internal air ballonets. Lobes terminate in inflated fins, trailing-edges of which are braced by a three-tube structure supporting outboard pusher engine that vectors with the trailing-edge rudders. Flexible tubes, in sheaths along the grooves of each lobe, improve rigidity during partial deflation and are connected by shorter tubes at the stern.

POWER PLANT: Two 5.0 kW (6.7 hp) piston engines, in pusher configuration at tail, each driving a two-blade pusher propeller.

ACCOMMODATION: One or two seats.

DIMENSIONS, EXTERNAL:

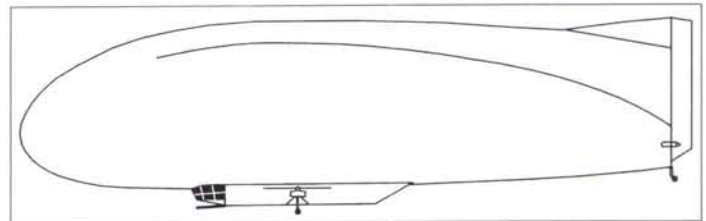
Length overall	18.00 m (59 ft 0¼ in)
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DIMENSIONS, INTERNAL:

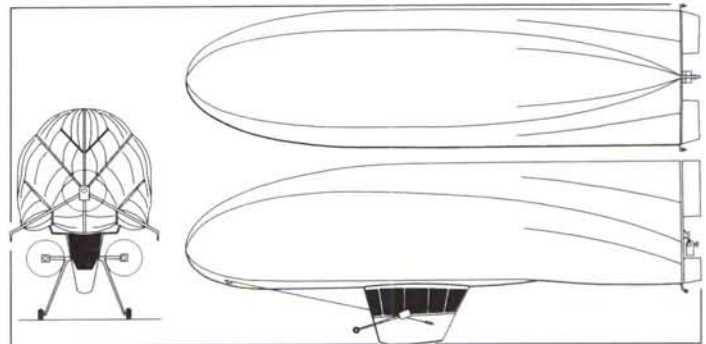
Envelope/wings volume, total	250.0 m ³ (8,830 cu ft)
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PERFORMANCE:

Max level speed	27 kt (50 km/h; 31 mph)
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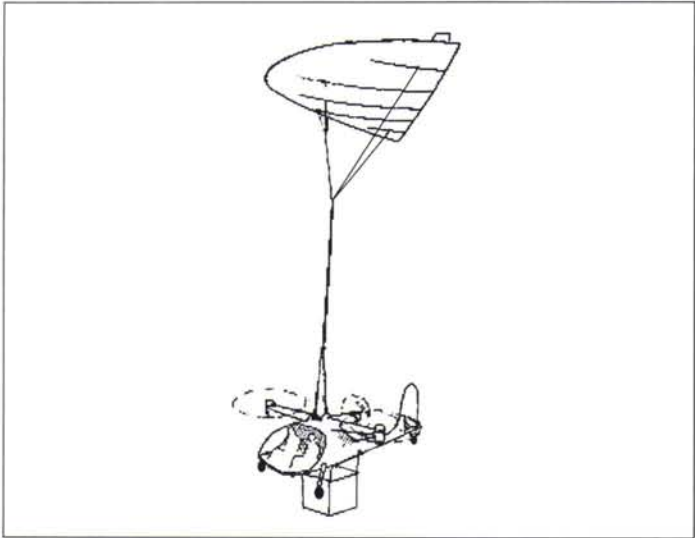
Liftium Fret 20T, showing sustaining rotors projecting from sides of gondola 1046951



Liftium-shape light dirigible, showing landing gear retracted in side view (Paul Jackson) 1047724

LIFTIUM HAL

TYPE: Lifting vehicle.
PROGRAMME: Design study.
DESIGN FEATURES: *Hélicoptère Allégé* (Reduced Helicopter). Combines helicopter with propeller and auxiliary lifting surface in the form of a thick, inflatable, delta aerofoil from which the fuselage is suspended by cables; intended for carriage of external loads.
Twin helicopter rotors (without cyclic pitch control) provide vertical lift capability; forward motion supplied by pusher propeller amidships, above cutaway rear fuselage; conventional tailfin. At cruising speed, the auxiliary aerofoil offloads the rotors, which are then stopped. Twin fins on upper surface of the aerofoil maintain its orientation in the direction of the relative wind, thereby balancing lift. The aerofoil can be drawn down and picketed alongside the fuselage when the aircraft is parked.



Designer's sketch of Liftium HAL. Note aerofoil orientated with the relative wind 1046950

NOIN

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Web: www.alpaero.com
DIRECTOR: Claude Noin

Company formed 1976. The Exel is the fourth design produced by Claude Noin, whose father was a noted soaring pilot of the 1950s and was first to cross the Alps by glider. The company's earlier Sirius motor glider (22 produced) is no longer available, although it will return to active status if interest in design is increased.

NOIN CHOUCAS

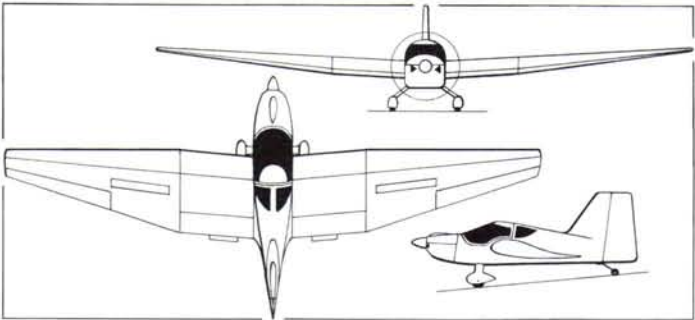
English name: Jackdaw
TYPE: Side-by-side ultralight kitbuilt.
PROGRAMME: Design started 1994 by Claude Noin; construction of prototype started 1995; first flight (05-CO) February 1996; second aircraft flown 30 July 2004. Marketed as basic kit for advanced builders, quoted build time 1,200 hours. A special version for physically handicapped pilots is to be launched, if there is sufficient demand. From May 2006 a fast-build kit and a ready-to-fly version were released.
CUSTOMERS: Two flying and one under construction by early 2005.
COSTS: Kit (glass fibre) EUR7,738, (carbon fibre) EUR8,756; fast-build kit EUR26,670; ready-to-fly with Rotax 503 EUR50,125, excluding taxes (all 2006).
DESIGN FEATURES: Tail-less design, stated to be stallproof and spinproof; design aimed at meeting ultralight category certification requirements while matching performance of modern gliders and conventional three-axis ultralight aircraft. Dihedral 4°; zero twist.
FLYING CONTROLS: Unconventional flying wing; pitch control by elevators in inboard wing trailing-edge; ailerons outboard; large rudder. Trim tabs on elevators; spoilers/airbrakes on upper surface of wing.
STRUCTURE: Standard fuselage moulded in half-shells of carbon fibre/epoxy; glass fibre/epoxy fuselage available at lower cost for advanced builders, but with weight penalty; composites wing structure with carbon fibre main spar, glass fibre/epoxy-stiffened Styrofoam ribs and birch plywood D-section leading-edge, covered with heat-shrink Dacron; moulded carbon fibre/epoxy ailerons; Lexan/polycarbonate canopy with carbon fibre frame. Optional 0.65 m (2 ft 1½ in) wing extension available.
LANDING GEAR: Tailwheel type, fixed. Fuselage-mounted spring cantilever mainwheel legs with wheel fairings; drum brakes.
POWER PLANT: One 37.0 kW (49.6 hp) Rotax 503 UL-2V with 2.58:1 reduction gear driving a two-blade ground-adjustable DUC 20 carbon fibre propeller. Fuel capacity 36 litres (9.5 US gallons; 7.9 Imp gallons), of which 35 litres (9.25 US gallons; 7.7 Imp gallons) are usable.
ACCOMMODATION: Two, side by side beneath one-piece upward-hinging canopy; baggage shelf to rear of seats.
SYSTEMS: 14 V DC alternator provides electrical power.
AVIONICS (factory-built aircraft): Comms: VHF comm and intercom.
Instrumentation: ASI, altimeter, variometer, slip indicator, compass, tachometer, fuel gauge, chronometer, CHT and EGT gauges and voltmeter.
EQUIPMENT: BRS 5 ballistic parachute recovery system optional.

DIMENSIONS, EXTERNAL:

Wing span	14.35 m (47 ft 1 in)
Length overall	5.35 m (17 ft 6½ in)
Height overall	1.95 m (6 ft 4¾ in)
Propeller diameter	1.60 m (5 ft 3 in)



First Noin Choucas ultralight kitbuilt 1159271



Noin Choucas tail-less light aircraft (Jane's/James Goulding) 1159378

DIMENSIONS, INTERNAL:

Cabin max width	0.97 m (3 ft 2 in)
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AREAS:

Wings, gross	21.30 m² (229.3 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	260–290 kg (573–639 lb)
Max T-O weight:	
FAI ultralight certification	450 kg (992 lb)
motor glider certification	510 kg (1,124 lb)

PERFORMANCE, POWERED:

Max level speed	97 kt (180 km/h; 111 mph)
Cruising speed at 75% power	70 kt (130 km/h; 81 mph)
Stalling speed	33 kt (60 km/h; 38 mph)
Max rate of climb at S/L	180 m (590 ft)/min
T-O run	100 m (330 ft)
Landing run	150 m (495 ft)
Range at 75% power, no reserves	175 n miles (325 km; 201 miles)

PERFORMANCE, UNPOWERED:

Best glide ratio	23
Min rate of sink	less than 1.00 m (3.28 ft)/s

NOIN EXEL

TYPE: Single-seat ultralight/motor glider/kitbuilt.
PROGRAMME: Design started 1997; first flight of prototype September 1998; construction of first production aircraft began 1999. Marketed as fast-build kit or ready to fly.
CUSTOMERS: Total of nine ordered and delivered by end 2005, including one export to Chile.
COSTS: Kit less engine, propeller and instruments, EUR23,900; ready-to-fly EUR33,000 plus tax (2006).
DESIGN FEATURES: Pod-and-boom configuration, with T tail. Aimed at meeting FAI ultralight and JAR 22 certification criteria. Quoted construction time of fast-build kit, 300 hours.
FLYING CONTROLS: Conventional and manual; cable-operated elevators, flaperons and rudder; three-position flaps, deflections -5, 0 and +5°. Airbrakes on upper wing surfaces.
STRUCTURE: Fuselage moulded in half-shells of glass fibre/epoxy with plywood bulkheads. Wings have carbon fibre spar caps and glass fibre skins. Fabric-covered rudder. Optional winglets. Quoted build time 300 hours.



Noin Exel single-seat ultralight motor glider 1159272

LANDING GEAR: Monowheel type; fixed. Tailwheel incorporated in base of rudder for directional control on the ground; small outrigger wheel at each wingtip. Drum brake on mainwheel.

POWER PLANT: One 13.4 kW (18 hp) JPX D-320 two-stroke flat twin with 2.38:1 reduction drive to a carbon fibre two-blade folding pusher propeller (three-blade propeller being tested October 2001). A 20.9 kW (28 hp) Hirth F-33 was being tested during early 2006. Fuel capacity 19 litres (5.0 US gallons; 4.2 Imp gallons).

EQUIPMENT: Optional ballistic parachute recovery system.

DIMENSIONS, EXTERNAL:

Wing span	13.74 m (45 ft 1 in)
Length overall	5.90 m (19 ft 4¼ in)
Propeller diameter	1.28 m (4 ft 2½ in)

AREAS:

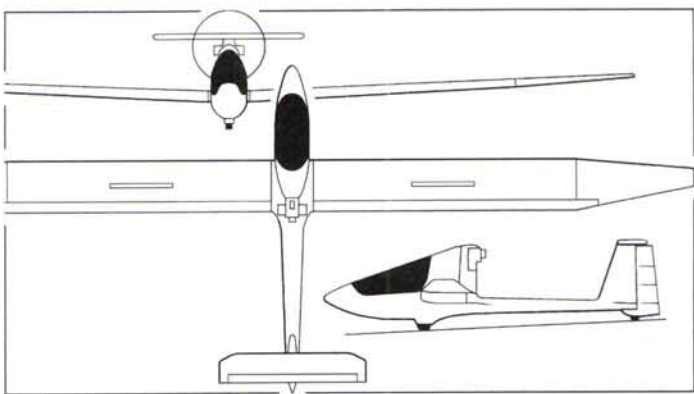
Wings, gross	11.62 m ² (125.1 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	196 kg (432 lb)
Max T-O weight	310 kg (683 lb)

PERFORMANCE, POWERED:

Never-exceed speed (VNE)	97 kt (179 km/h; 111 mph)
Cruising speed at 75% power	65 kt (120 km/h; 75 mph)
Stalling speed	34 kt (63 km/h; 40 mph)
Max rate of climb at S/L	120 m (394 ft)/min
T-O run	150 m (492 ft)
Landing run	140 m (459 ft)
Endurance	3 h
g limits	+4.4/-2.2



Noin Exel (JPX D-320 engine) (Paul Jackson) 1159379

PERFORMANCE, UNPOWERED:

Best glide ratio	30
Min rate of sink	0.75 m (2.5 ft)/s

PROTOPLANE

PROTOPLANE AIRCRAFT DESIGN & PROTOTYPING

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Tel: (+33 5) 62 95 36 31
Fax: (+33 5) 62 95 45 27
e-mail: info@protoplane.net
Web: www.protoplane.net
DIRECTOR: Béla Nogrady
WORKS MANAGER: Martine Zampieri

Company formed in 1999 to develop Massai and Ultra series of aircraft and has subsequently branched into design and embodiment of structural modifications of business aircraft, airliners and helicopters.

M Nogrady, an amateur aircraft constructor since the age of 19, has also been involved in design of other aircraft, including the Campana Aviation Campana.

PROTOPLANE MASSAI

TYPE: Side-by-side ultralight motor glider/kitbuilt.

PROGRAMME: First reported in early 2002, when maiden flight said to be imminent. However, only a mockup was displayed at Paris in June 2003, since which time no further reports have been received, although low-intensity promotion was continuing in 2006.

A short-wing, tricycle gear version was developed and has become the Ultra, described separately.

DESIGN FEATURES: Low-wing motor glider with retractable landing gear and retractable propeller behind forward-sliding nosecone. Constant-chord inboard wing; outer panels with curved taper on leading- and trailing-edges. Constant-chord tailplane at base of sweptback fin. JAR 22 conformal.

Wing section FX66-17AII-182/26 at root; FX60-126.1/26 at tip. Dihedral 3°. Tailplane section FX71-L-150/35; fin FX71-L-117/33.

FLYING CONTROLS: Conventional and manual. Two-section ailerons extend over tapered and constant-chord sections. Flaps, max deflection 35°. Schempp-Hirth airbrakes.

STRUCTURE: Composites throughout.

LANDING GEAR: Monowheel type; retractable, including retractable (inward) outriggers at one-third span. Semi-buried tailwheel, mainwheel size 5.00-5; outriggers 125x45. Hydraulic disc brake.

POWER PLANT: One 48.0 kW (64.5 hp) Rotax 582 piston engine driving a 1.68 m (5 ft 6¼ in) diameter two-blade Protoplane wood and glass fibre folding ('Z-type') propeller via a belt reduction system. Fuel capacity 70 litres (18.5 US gallons; 15.4 Imp gallons).

ACCOMMODATION: Two persons, side by side, beneath single piece, forward-hinged canopy.

EQUIPMENT: Provision for surveillance sensors.

DIMENSIONS, EXTERNAL:

Wing span	16.38 m (53 ft 8¾ in)
Length overall, propeller retracted	7.42 m (24 ft 4¼ in)

AREAS:

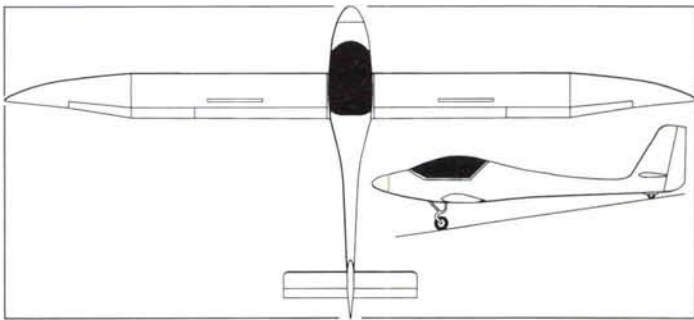
Wings, gross	15.46 m ² (166.4 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	250 kg (551 lb)
Max T-O weight	450 kg (992 lb)



Protoplane Massai at Paris In June 2003 (Paul Jackson) 0567725



Two elevations of Protoplane Massai (Paul Jackson) 1158262

PERFORMANCE, POWERED:

Cruising speed	119 kt (220 km/h; 137 mph)
Max rate of climb at S/L	330 m (1,083 ft)/min
T-O run	73 m (240 ft)
Landing from 15 m (50 ft)	195 m (640 ft)
Range	449 n miles (832 km; 517 miles)
g limits	+5.73/-3.73

PERFORMANCE, UNPOWERED:

Stalling speed, flaps down	30 kt (55 km/h; 35 mph)
Best glide ratio	36
Min rate of sink	0.61 m (2.00 ft)/s

PROTOPLANE ULTRA

TYPE: Side-by-side ultralight/kitbuilt.

PROGRAMME: Short-wing, tricycle-gear version of Massai powered glider. Public debut by prototype (registered F-WAAM) at Blois, France, September 2004, when marketed as Songh'Air Songhai. Licensing agreement with Songh'Air of Carcassonne was later cancelled, and at 2005 Blois show the aircraft had been renamed as above.

CURRENT VERSIONS: **Ultra:** Baseline version; glass fibre-Herex construction.

Ultra S: Carbon fibre construction, including Kevlar/Rohacell empennage. As described.

COSTS: Kit EUR37,800 or Ultra S EUR44,300; flyaway, EUR64,600 or Ultra S EUR71,100, all plus tax (2006).

DESIGN FEATURES: Conforms to CS-VLA requirements. Low, constant-chord, high aspect ratio wing; offers high cruising speed on low power. Wings removable for storage by two persons.

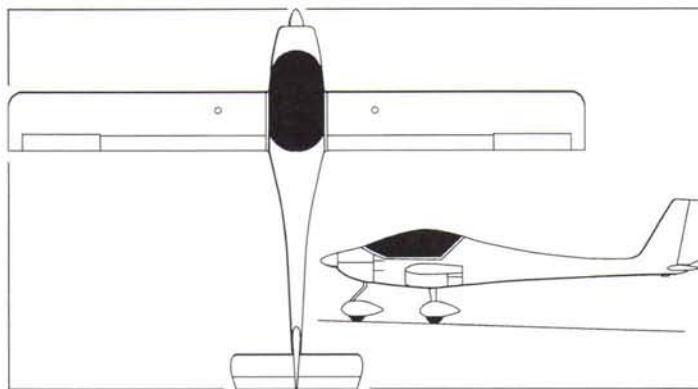
Wing section FX66-17AII-182/26; tailplane section FX71-L-150/35; fin section NACA 0009.

FLYING CONTROLS: Conventional and manual. Pushrod actuation throughout. Three-position flaps; 0, 15 and 35°.

STRUCTURE: Generally of glass fibre/epoxy-Herex sandwich composites, with carbon fibre-epoxy wing spar and local fuselage strengthening. Fuselage of left, right and lower shells.



Protoplane Ultra two-seat ultralight 1158267



General arrangement of Protoplane Ultra (Paul Jackson)

1158259

glued and reinforced by carbon frames; wing shells top and bottom, reinforced by four carbon ribs. Empennage of Kevlar/epoxy-Rohacell sandwich. Engine cowling, cockpit interior and wheel fairings of glass fibre.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring Zicral alloy cantilever mainwheel legs with optional wheel fairings. Trailing link nosewheel with fairing. All tyres 5.00-5. Hydraulic mainwheel brakes.

POWER PLANT: One 59.7 kW (80 hp) Jabiru 2200 flat-four driving an Arplast TD152 two-blade propeller. Two structural fuel tanks in wing leading-edges; total capacity 90 litres (23.8 US gallons; 19.8 Imp gallons).

DIMENSIONS, EXTERNAL:

Wing span 11.00 m (36 ft 1 in)
Length overall 7.24 m (23 ft 9 in)
Height overall 2.32 m (7 ft 7 1/4 in)

DIMENSIONS, INTERNAL:

Cockpit max width 1.10 m (3 ft 7 1/4 in)

AREAS:

Wings, gross 12.10 m² (130.2 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 250 kg (551 lb)
Max T-O weight 450 kg (992 lb)

PERFORMANCE, POWERED:

Never-exceed speed (VNE) 147 kt (272 km/h; 169 mph)
Max level speed 132 kt (245 km/h; 152 mph)
Cruising speed 124 kt (229 km/h; 142 mph)
Max rate of climb at S/L 480 m (1,574 ft)/min
T-O run 48 m (160 ft)
Landing from 15 m (50 ft) 220 m (725 ft)
Range with max fuel 842 n miles (1,560 km; 969 miles)
g limits +5.3/-2.65

PERFORMANCE, UNPOWERED:

Stalling speed, clean (flaps 35°) 30 kt (55 km/h; 35 mph)
Best glide ratio 22
Min sink rate at 53 kt (98 km/h; 61 mph) 1.11 m (3.64 ft)/s

REIMS

REIMS AVIATION INDUSTRIES

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DIRECTOR GENERAL: Philippe Denavit

VICE-PRESIDENT, MARKETING AND SALES: Philippe Denavit

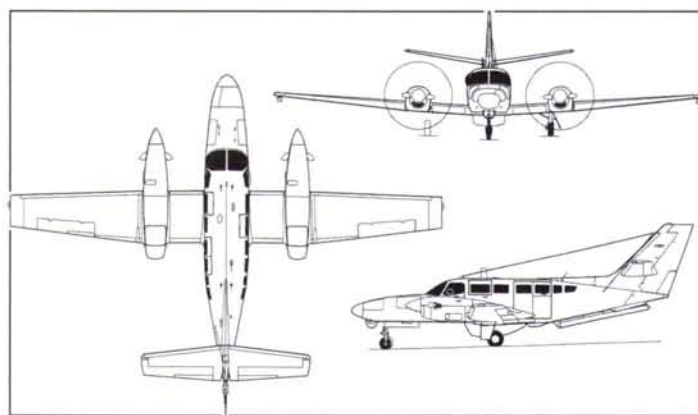
AREA SALES MANAGER: Laurent Mesmin

EXTERNAL RELATIONS: Max Boirame

Originally Avions Max Holste, founded 1933; Cessna acquired 49 per cent share in February 1960; name then changed to Reims Aviation, which licensed to manufacture Cessna aircraft for sale in Europe, Africa and Asia, but stopped making small piston-engined types when Cessna did; Reims had built 6,351 aircraft of all types by late 2001. Reims developed twin-turboprop F406 Caravan II (see below); but Cessna sold its share in Reims Aviation to Compagnie Française Chaufour Investissement (CFCI) in early 1989.

Filed for bankruptcy protection on 30 October 2002 following loss of aerostructures work in wake of Fairchild Dornier's bankruptcy. Company sold in two separate parts, with aerostructures and light aircraft maintenance becoming Reims Aerospace under ownership of Austrian group, Ventana.

Caravan production, marketing and maintenance activities purchased by Green Recovery venture capital group, becoming Reims Aviation Industries. Employees in 2003 totalled 40. Expansion plans included manufacture of four aircraft in 2004, but this not achieved in that or the following year.



Reims F406 Vigilant Surpolmar maritime surveillance aircraft

0547130

REIMS F406 CARAVAN II

TYPE: Utility turboprop twin.

PROGRAMME: Announced mid-1982; first flight (F-WZLT) 22 September 1983; French certification 21 December 1984, FAA 28 August 1986; first flight production F406 (F-ZBEO) 20 April 1985.

CURRENT VERSIONS: **F406 Caravan II:** Initial production version, available in passenger, freight (with underbelly cargo pod), medevac, skydiving, aerial survey, training, navaid calibration and target towing variants. These retrospectively known as **F406 Mark I**.

F406 Mark II: Upgraded version announced (as F406 NG New Generation) in October 2000. Features include 473.5 kW (635 shp) PT6A-135A engines driving four-blade propellers; reduced structural weight; same MZFW; increase in maximum take-off weight to 4,700 kg (10,361 lb); quick-release access panels for easier maintenance; new lightweight instrument panel with liquid crystal displays; redesigned cabin interior by Air Esthetic featuring composites panels that can be painted or upholstered, improved acoustic and thermal insulation, new ergonomically designed seats with integral harnesses for improved comfort on long missions and integral window blinds; and standard Bendix/King Silver Crown avionics with Silver Crown Plus comms and two-tube EFIS display. Three standard cabin interiors offered: commuter, special missions and VIP. Take-off, climb and OEI rate of climb performance are improved, and endurance increased by up to one hour.

Additionally, six versions of the basic **Special Missions** configuration, each with a ventral 360° radar:

Vigilant: Surveillance version (land or sea) with mission equipment to suit customer requirement, including (in latest configuration) Thales Airborne Maritime Situation Control System (AMASCOS) which comprises belly-mounted Telephonics AN/APS-143, Texas Instruments 1022 or Thales/DASA Ocean Master 100/200 360° surveillance radars, chin-mounted FLIR turret for FSI Ultra, Inframetrics Mk III, SAGEM Hesis, Star Safire, Thales Chlio or Wescam FLIR, mission management and communications systems and single operator's console in Srs 100 form; or with additional console for electronic surveillance operator in Srs 200. BAE Systems Seaspray 2000 radar for Scottish Fisheries; Texas Instruments AN/APS-134 radar for Australian Customs.

Vigilant Frontier: Border patrol and anti-drug surveillance version with mission equipment including surveillance radar in anti-drug configuration, FLIR and datalink.

Vigilant Polmar II: Pollution surveillance (maritime police) version with SAGEM Cyclope 2000 IR linescanner and Ericsson or Terma SLAR.

Vigilant Polmar III: As Polmar II, but with updated survey systems and LLTV camera in chin turret. One upgrade ordered by French Customs in 2001 and delivered to Lorient-Lann Bihoué on 23 November 2004.

Vigilant Surmar: Surveillance (maritime) version with 360° radar, such as Texas Instruments AN/APS-134 or Telephonics AN/APS-143 and optional equipment including

L-3 Wescam MX-15 FLIR turret and Litton night vision system. In 1996 Reims developed underwing hardpoints for the F406 which enable it to carry light weapons such as machine gun pods or rocket launchers, or camera pods or SAR liferafts.

Vigilant Surpolmar: Maritime surveillance version for Hellenic Coast Guard, combining Surmar and Polmar missions. Equipment specific to Greek aircraft comprises Surmar suite of Honeywell 1500B radar and FLIR. Systems Star Safire turret aided by Caledonian Airborne Systems track-while-scan system for 20-target tracking; and Polmar suite of Ericsson SLAR, Swedish Space Corporation MSS 5000 and SAGEM Cyclope 2000 IR linescan.

Vigilant Imint: Dedicated imaging intelligence version with L-3 Wescam MX20 gyro-stabilised, retractable turret in ventral camera port. Promoted in 2005.

Vigilant Comint/Imint: Dedicated communications and imaging intelligence version of the Caravan II, developed jointly with Thomson-CSF Communications, first shown at Paris '97. Equipped with Thomson TCC SAS airborne elint system, an operator's console with MS Windows NT-based workstation and an array of direction-finding antennas housed in a ventral radome. Is also first Vigilant with a pair of underwing pylons for carriage of stores which can include gun or rocket pods and airdroppable SAR equipment.

F406 Cartography: Equipped with Vexcel camera and IGN France International mission system. Initial aircraft (c/n 092) delivered to Biruni Remote Sensing Centre of Libya on 5 April 2005.

CUSTOMERS: One prototype and 91 production aircraft built by mid-2005. Further four sold, including two to Scottish Fisheries, and one (second of type) to Namibian Ministry of Fisheries, last named (c/n 093) for delivery in 2006.

French Customs Service received 10 in Surmar and two in Polmar I/II configuration. One in Polmar III configuration (No. 90), ordered in late 2000 and intended for delivery in 2002 but delayed until first quarter 2004. First Surmar (No. 74, although registered as a Vigilant) handed over 11 January 1995, followed by Nos. 75 and 77 on 12 September 1995, the latter two replacing Cessna 404s in Martinique, French Antilles.

Recent customers for the F406 include the Republic of Korea Navy, which ordered five in target tug configuration, the first delivered on 23 November 1998 and the last in mid-June 1999, total contract value being USD24 million (1997); and the Hellenic Coast Guard, which, in June 1999, ordered two for delivery in late 2000 as Surpolmar variants and additional one in November 1999; the first Surpolmar (F-WWSS/AC-21) for this contract made its maiden flight on 21 August 2000 and was delivered on 27 March 2001; remaining two received by December 2001, at which time a fourth was under negotiation. One to Air Saint-Pierre in mid-2003, fitted with TCAS II (first produced by Reims Aviation Industries). Total 92 sold by October 2003 (excluding prototype). An agreement with the Brazilian government signed in April 1998 provides for the purchase of three aircraft in multisensor configurations. Puerto Rico Police Force ordered one in Vigilant Surmar configuration, for delivery in mid-2005.

COSTS: Standard commuter aircraft USD2.4 million (2003). Maritime patrol versions typically USD4 million to USD6 million with mission equipment. Korean Navy contract for five aircraft valued at USD24 million, including technician training and one-year technical support (1997). Greek contract for two Surmars valued at FFr90 million (1999); single Polmar FFr33 million (1999). Direct operating cost USD338 per hour (1997).



Reims F406 Caravan II operated on UK fisheries patrol by Directflight, fitted with RDR115 radar, FLIR turret and interferometer (Paul Jackson)

1128952

DESIGN FEATURES: Extrapolated from Cessna Conquest airframe; wing section NACA 23018 at root and 23012 at tip; dihedral 3° 30' on centre-section, 4° 55' on outer panels; twist -3°; incidence 2° at root; fin offset 1° to port; tailplane dihedral 9°; cabin not pressurised.

FLYING CONTROLS: Conventional and manual. Trim tabs in elevators, port aileron and rudder; hydraulically operated inboard and outboard Fowler flaps with 10, 20 and (inboard only) 30° fixed settings. Control surface movements: ailerons +25/-14°; elevators +14/17°; rudder ±32°.

STRUCTURE: Conventional light metal with three-spar fail-safe wing centre-section to SFAR 41C; two-spar outer wings.

LANDING GEAR: Hydraulically retractable tricycle type with single wheel on each unit. Mainwheel tyre size 22x7.75-10, nosewheel 6.00-6. Main units retract inward into wing, nosewheel rearward. Emergency extension by means of a 138 bar (2,000 lb/sq in) rechargeable nitrogen bottle, Cessna oleo-pneumatic shock-absorbers. Main units of articulated (trailing link) type. Single-disc hydraulic brakes. Parking brake.

POWER PLANT: Two Pratt & Whitney Canada PT6A-112 turboprops (each 373 kW; 500 shp), each driving a McCauley 3GFR34C701/93KB-0 three-blade, reversible-pitch, and automatically feathering metal propeller. Fuel in two wing tanks, combined capacity 1,823 litres (481 US gallons; 401 Imp gallons) of which 1,798 litres (475 US gallons; 395.5 Imp gallons) usable. Oil capacity 17.2 litres (4.5 US gallons; 3.8 Imp gallons).

ACCOMMODATION: Crew of two and up to 12 passengers, in pairs facing forward, with centre aisle, except at rear of cabin in 12/14-seat versions. Alternative basic configurations for six VIP passengers in reclining seats in business version, and for operation in mixed passenger/freight role. Business version has partition between cabin and flight deck, and lavatory on starboard side at rear. Split main door immediately aft of wing, on port side, with built-in airstair in downward-hinged lower portion. Optional cargo door forward of this door to provide single large opening. Overwing emergency exit on each side. Passenger seats removable for cargo carrying, or for conversion to ambulance, air photography, maritime surveillance and other specialised roles. Baggage compartments in nose, with three doors, at rear of cabin and in rear of each engine nacelle. Ventral cargo pod optional.

SYSTEMS: Freon air conditioning system of 16,000 BTU capacity, plus engine bleed air and electric boost heating. Electrical system includes 28 V 250 A starter/generator on each engine and 39 Ah Ni/Cd battery. Hydraulic system, pressure 120 bar (1,750 lb/sq in), for operation of landing gear. Separate hydraulic system for brakes. Optional Goodrich pneumatic de-icing of wings and tail unit, and electric windscreen de-icing.

AVIONICS: Standard Bendix/King Silver Crown; Gold Crown optional.

Comms: Dual Bendix/King transceivers.

Radar: Honeywell RDR 2000 weather radar optional. Maritime surveillance radar as described under Current Versions.

Flight: Dual ADF and marker beacon receiver. Autopilot optional.

Instrumentation: Provision for equipment to FAR Pt 135A standards, including dual controls and instrumentation for co-pilot.

EQUIPMENT: Optional cargo interior includes heavy-duty sidewalls, utility floorboards, cabin floodlighting and cargo restraint nets. Optional pylons under each wing for carriage of stores including gun or rocket pods and airdroppable SAR equipment. Optional camera hatch in lower rear fuselage; installed in 34 aircraft up to 2005.

DIMENSIONS, EXTERNAL:

Wing span	15.08 m (49 ft 5½ in)
Wing aspect ratio	9.7
Length overall	11.89 m (39 ft 0¼ in)
Height overall	4.01 m (13 ft 2 in)
Tailplane span	5.87 m (19 ft 3 in)
Wheel track	4.28 m (14 ft 0½ in)
Wheelbase	3.81 m (12 ft 6 in)
Propeller diameter	2.36 m (7 ft 9 in)
Cabin door: Height	1.27 m (4 ft 2 in)

Width	0.58 m (1 ft 10¼ in)
Cargo double door (optional):	
Total width	1.24 m (4 ft 1 in)

DIMENSIONS, INTERNAL:

Cabin (incl flight deck): Length	5.71 m (18 ft 8¾ in)
Max width	1.42 m (4 ft 8 in)
Max height	1.31 m (4 ft 3¼ in)
Min height (at rear)	1.21 m (3 ft 11½ in)
Width of aisle	0.29 m (11½ in)
Volume	8.6 m³ (305 cu ft)
Baggage compartment (nose):	
Length	2.00 m (6 ft 6¾ in)
Volume	0.74 m³ (26.0 cu ft)
Nacelle lockers: Length	1.55 m (5 ft 1 in)
Width	0.73 m (2 ft 4¾ in)
Baggage volume: total, internal	2.2 m³ (79 cu ft)
incl cargo pod	3.5 m³ (124 cu ft)

AREAS:

Wings, gross	23.48 m² (252.8 sq ft)
Ailerons (total)	1.36 m² (14.64 sq ft)
Trailing-edge flaps	3.98 m² (42.84 sq ft)
Fin	4.05 m² (43.59 sq ft)
Rudder, incl tab	1.50 m² (16.15 sq ft)
Tailplane	5.81 m² (62.54 sq ft)
Elevators, incl tabs	1.66 m² (17.87 sq ft)

WEIGHTS AND LOADINGS:

Standard empty weight	2,283 kg (5,033 lb)
Max payload	2,219 kg (4,892 lb)
Max fuel weight	1,444 kg (3,183 lb)
Max ramp weight: except FAA	4,502 kg (9,925 lb)
FAA	4,279 kg (9,435 lb)
Max T-O and landing weight: except FAA	4,468 kg (9,850 lb)
FAA	4,245 kg (9,360 lb)
Max zero-fuel weight	3,856 kg (8,500 lb)
Max wing loading	190.3 kg/m² (38.97 lb/sq ft)
Max power loading	5.99 kg/kW (9.85 lb/shp)

PERFORMANCE:

Max operating Mach No. (MMO)	0.52
Max operating speed (VMO)	229 kt (424 km/h; 263 mph) IAS
Max cruising speed	246 kt (455 km/h; 283 mph)
Econ cruising speed	200 kt (370 km/h; 230 mph)
Stalling speed:	
wheels and flaps up	94 kt (174 km/h; 108 mph) IAS
wheels and flaps down	81 kt (150 km/h; 93 mph) IAS
Max rate of climb at S/L	564 m (1,850 ft)/min
Rate of climb at S/L, OEI	121 m (397 ft)/min
Max certified altitude	9,145 m (30,000 ft)
Service ceiling, OEI	4,935 m (16,200 ft)
T-O run	526 m (1,725 ft)
T-O to 15 m (50 ft)	803 m (2,635 ft)
Landing from 15 m (50 ft), without reverse pitch	674 m (2,215 ft)
Range with max fuel, at max cruising speed, 45 min reserves	1,153 n miles (2,135 km; 1,327 miles)

g limits +3.6/-1.44

OPERATIONAL NOISE LEVELS:

Flyover	72.0 EPNdB
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ROBIN

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Web: www.apex-aircraft.com
NON-EXECUTIVE CHAIRMAN: Philippe Corne
CEO AND GENERAL MANAGER: Guy Pellissier
SALES MANAGER, EUROPE: Pierre Pelletier

Formed October 1957 as Centre Est Aéronautique; name changed to Avions Pierre Robin 1969; acquired July 1988 by Compagnie Française Chaufour Investissement (CFCI) and incorporated into Aéronautique Service group (now Apex International) with Robin SA (after-sales support company of Dijon Val-Suzon); Pierre Robin left company 1990. Total of some 3,770 aircraft produced by late 2004 (excluding 35 Sperwer UAVs). Factory area (Constructions Aéronautiques de Bourgogne) 9,000 m² (96,875 sq ft).
Former Robin subdivisions, Constructions Aéronautiques de Bourgogne and Aéronautique Finance et Services, are now separate companies. The first-mentioned is responsible for the construction of Robin aircraft, as explained in the entry for Aéronautique Service.
Latest production addition to Robin range is R 2120 Alpha trainer, introduced 2001. However, on 25 June 2004 Alpha Aviation of New Zealand announced its plans to acquire the R 2120 programme and transfer manufacture from Europe, leaving Robin to concentrate on its range of wooden aircraft.
Robin's parent company, Apex Aircraft, emerged from voluntary receivership 25 August 2003.

ROBIN DR 400 DAUPHIN

English name: Dolphin
TYPE: Four-seat lightplane.
PROGRAMME: First flight original DR 400 Petit Prince 15 May 1972; based on DR 300, but with forward-sliding canopy: DR 400/100 Cadet (two-seat) and DR 400/108 Dauphin 80 included among early versions. French and UK certification 1977; DR 400 Dauphin introduced 1979; improvements introduced 1988 and 1993.
CURRENT VERSIONS: **DR 400/100:** Discontinued. Former names: 2+2, Tricycle and Cadet.
DR 400/120 Dauphin 2+2: Production version with 88.0 kW (118 hp) engine, to carry two adults and two children. Based on former DR 400/120 Petit Prince, but with extra cabin windows.
DR 400/125i: Version of Dauphin 2+2 with fuel-injected 93.2 kW (125 hp) Teledyne Continental IO-240 driving three-bladed Mühlbauer constant-speed propeller, diameter 1.70 m (5 ft 7 in); prototype (F-WNNK) first flown 1995 and made its public debut at the Paris Air Show in June 1995; engine/propeller combination improves take-off, climb and cruising performance and reduces noise levels; one delivered in 1996. Weights and performance data in 2000-01 and earlier editions. No further production.
DR 400/135 Ecoflyer: Version of Dauphin 2+2 with 99 kW (132.8 hp) Thielert Centurion 1.7 aero diesel engine driving an MT variable-pitch propeller; prototype (D-ECDI) completed ground running tests in August 2003 and first flew 10 October 2003. All DR 400/135s are built as DR 400/140Bs and converted before delivery to customers. EASA certification July 2005; first delivery 25 July 2005. PH-VSQ to Vliegclub Seppe, Netherlands.
DR 400/140B Dauphin 4: Full four-seater with 119 kW (160 hp) engine. Previously known as Major 80, which replaced DR 400/140 Major and Earl.
DR 400/160 and DR 400/180: Described separately.
CUSTOMERS: Some 1,881 of DR 400 series built by late 2005. Exports mainly to Germany, Switzerland and UK.

ROBIN DR 300/400/500 PRODUCTION (1968-2005)					
Variant	Qty	Qty	Qty	First aircraft	Date
DR 315	100			F-BPKY	1968
DR 340	61			F-BPOO	1968
DR 360	30			F-BPOQ	1968
DR 380	22			F-BRCP	1969
DR 300-108	92			F-BRVV	1970
DR 300-120	3			F-ZVMG	1971
DR 300-125	41			F-BRZR	1970
DR 300-140	2			F-BPXX	1970
DR 300-180R	42			F-BPXY	1970
Subtotal	393				
DR 400-100		153		G-BAGS	1972
DR 400-108		1		F-BTKZ	1973
DR 400-120		395		F-BTKC	1972
DR 400-120A		16		F-BUPJ	1973
DR 400-120D		18		D-EGWU	1981
DR 400-120P		1		F-WLKJ	1992
DR 400-125		19		F-BTBA	1972
DR 400-135TDi				D-ECDI	2003
DR 400-140		66		G-BAGC	1972
DR 400-140B		185		F-BUHE	1973
DR 400-160		175		F-OCSR	1972
DR 400-160D		4		D-EEVA	1982
DR 400-180		412		D-ENTB	1973
DR 400-180C		1		TC-FAM	1985
DR 400-180R		366		OE-DSB	1973
DR 400-180RD		1		LN-DFK	2003
DR 400-180RP		31		F-WIEQ	1985
DR 400-180S		15		HB-KAT	1985
DR 400-200R		14		F-ZWWX	1993
DR 400-200i		1		F-WZZY	1997
DR 400-V65		1		F-WGXT	1995
DR 400-NGL		1		F-WGXT	1988
Not known		6			
Subtotal		1,881			
DR 500-200i			40	F-WZZY	
DR 500C			1	F-WZZY	2002
Subtotal			41		
Prototypes:					



Robin DR 400/120, lowest-powered of current Dauphins (Paul Jackson) 1128953

Variant	Qty	Qty	Qty	First aircraft	Date
DR 315-01	1			F-WOFT	1968
DR 340-01	1			F-WOFP	1968
DR 360-01	1			F-WOFS	1968
DR 380-01	1			F-WPXC	1968
DR 400-125-02		1		F-WSQT	1972
DR 400-160-03		1		F-WSQZ	1972
DR 400-180-01		1		F-WSQQ	1972
Total	397	1,884	41		

1 Conversions of DR 400/140B

DESIGN FEATURES: Typical Jodel-type design with low wing of constant chord inboard, but tapered, dihedral outer panels. Mid-positioned tailplane and swept fin leading-edge.
Wing section NACA 23013.5 modified with leading-edge droop; centre panels parallel chord, slight twist; outer panels tapered with dihedral 14°; twist -6°.
FLYING CONTROLS: Manual. Conventional ailerons and rudder. All-moving tailplane with trimmable anti-balance tab on each side; plain flaps.
STRUCTURE: All-wood; single box spar with ribs threaded over box; plywood-covered leading-edge box; polyester fabric covering elsewhere; fuselage plywood-covered; flaps all-metal and interchangeable; ailerons interchangeable.
LANDING GEAR: Non-retractable tricycle type, with long-stroke oleo-pneumatic shock-absorbers and hydraulically actuated disc brakes. All three wheels and tyres are size 380x150, pressure 1.57 bar (23 lb/sq in) on nose unit, 1.77 bar (26 lb/sq in) on main units. Nosewheel steerable via rudder bar. Fairings over all three legs and wheels. Tailskid with damper. Toe operated disc brakes and parking brake.
POWER PLANT: *Dauphin 2+2:* One 88.0 kW (118 hp) Textron Lycoming O-235-L2A flat-four engine, driving a Sensenich 72CK56-0-56 two-blade, fixed-pitch aluminium propeller, or Hoffmann two-blade wooden propeller.
Dauphin 4: One Textron Lycoming O-320-D2A flat-four engine developing 104 kW (140 hp) at 2,300 rpm and 119 kW (160 hp) at 2,700 rpm. Sensenich 74DM6S5-2-64 propeller.
DR400/135 cdi Ecoflyer: One TAE Centurion 1.7 diesel engine, rated at 99.0 kW (132.8 hp), driving an MT-Propeller, three-blade, variable-pitch metal propeller. Fuel tank in fuselage, capacity 110 litres (29.1 US gallons; 24.2 Imp gallons) with filler port on left side; Dauphin 4 has optional 51 litre (13.5 US gallon; 11.2 Imp gallon) auxiliary tank, with filler port on right side. Oil capacity 5.7 litres (1.5 US gallons; 1.25 Imp gallons).
ACCOMMODATION: Enclosed cabin, with fore-and-aft adjustable seats for three or four persons. Three-point inertia-reel harnesses standard. Maximum weight of 154 kg (340 lb) on front pair and 136 kg (300 lb), including baggage, at rear in Dauphin 2+2. Additional 55 kg (121 lb) of disposable load in Dauphin 4. Access via forward-sliding jettisonable transparent canopy. Dual controls standard. Cabin heated and ventilated. Baggage compartment with internal access.
SYSTEMS: Standard equipment includes a 12 V 50 A alternator, 12 V 32 Ah battery, electric starter, audible stall warning and windscreen de-icing.
AVIONICS: To customer's choice, typically Bendix/King KX 155 nav/com, KI 208 VOR/LOC indicator, KT 76C transponder with ACK 30 altitude encoder, Garmin 150 XL GPS, and SPA 400 intercom system, four microphone and headset jack plugs, and PTT switch on each control stick.
Instrumentation: Standard equipment includes ASI, sensitive altimeter, rate of climb indicator, artificial horizon, directional gyro, electric turn co-ordinator, magnetic compass, recording tachometer, eight-light annunciator/warning panel with dimmer, oil pressure and temperature gauges, fuel quantity gauges, fuel pressure gauge, and flight time recorder. 135 CDI has electronic engine instrumentation. Options include OAT gauge, CHT gauge, EGT gauge, and carburettor air temperature indicator.
EQUIPMENT: Standard equipment includes navigation lights, taxiing and landing light, anti-collision strobe light, instrument panel lighting, and overall polyurethane paint with two-colour scheme. Options include pitot heat, external power socket, alternative static source, and additional exhaust silencer.
DIMENSIONS, EXTERNAL:
Wing span 8.72 m (28 ft 7¼ in)
Wing chord:
centre-section, constant 1.71 m (5 ft 7½ in)
at tip 0.90 m (2 ft 11½ in)



Cockpit of Robin Ecoflyer (Jane's/Jamie Hunter) 1128920



First Robin DR 400/135 cdi Ecoflyer on British civil aircraft register (*Jane's/Jamie Hunter*)

1128919

Wing aspect ratio	5.6	T-O to 15 m (50 ft): 2+2	535 m (1,755 ft)
Length overall	6.96 m (22 ft 10 in)	4	485 m (1,595 ft)
Height overall	2.23 m (7 ft 3¾ in)	Landing from 15 m (50 ft): 2+2	460 m (1,510 ft)
Tailplane span	3.20 m (10 ft 6 in)	4, 135 cdi	470 m (1,541 ft)
Wheel track	2.60 m (8 ft 6¼ in)	Landing run: 2+2	200 m (660 ft)
Wheelbase	5.20 m (17 ft 0¾ in)	4	220 m (725 ft)
Propeller diameter: 2+2	1.83 m (6 ft 0 in)	Range with standard fuel at 65%, no reserves: 2+2	495 n miles (916 km; 569 miles)
4	1.88 m (6 ft 2 in)	4	447 n miles (828 km; 514 miles)
DIMENSIONS, INTERNAL:		135 cdi	648 n miles (1,200 km; 745 miles)
Cabin: Length	1.62 m (5 ft 3¾ in)	Range, with optional fuel at 65% power, no reserves	
Max width	1.10 m (3 ft 7¼ in)	4	645 n miles (1,195 km; 742 miles)
Max height	1.23 m (4 ft 0½ in)	135 cdi	971 n miles (1,800 km; 1,118 miles)
Baggage volume	0.39 m³ (13.8 cu ft)		
AREAS:			
Wings, gross	13.60 m² (146.4 sq ft)		
Ailerons, total	1.15 m² (12.38 sq ft)		
Flaps, total	0.70 m² (7.53 sq ft)		
Fin	0.61 m² (6.57 sq ft)		
Rudder	0.63 m² (6.78 sq ft)		
Horizontal tail surfaces, total	2.88 m² (31.00 sq ft)		
WEIGHTS AND LOADINGS:			
Weight empty, equipped: 2+2	550 kg (1,212 lb)		
4	580 kg (1,279 lb)		
135 cdi	628 kg (1,385 lb)		
Max baggage: 2+2, 4	40 kg (88 lb)		
Max T-O and landing weight: 2+2	900 kg (1,984 lb)		
135 cdi	980 kg (2,160 lb)		
4	1,000 kg (2,205 lb)		
Max wing loading: 2+2	66.2 kg/m² (13.56 lb/sq ft)		
135 cdi	72.0 kg/m² (14.75 lb/sq ft)		
4	73.5 kg/m² (15.05 lb/sq ft)		
Max power loading: 2+2	10.23 kg/kW (16.81 lb/hp)		
135 cdi	9.89 kg/kW (16.26 lb/hp)		
4	8.38 kg/kW (13.78 lb/hp)		
PERFORMANCE:			
Never-exceed speed (VNE):			
2+2, 4	166 kt (308 km/h; 191 mph)		
Max level speed at S/L:			
2+2	130 kt (241 km/h; 150 mph)		
4	143 kt (265 km/h; 165 mph)		
Cruising speed at 75% power:			
2+2	116 kt (215 km/h; 133 mph)		
135 cdi	126 kt (233 km/h; 145 mph)		
4	128 kt (237 km/h; 147 mph)		
Stalling speed, flaps down:			
2+2	45 kt (82 km/h; 51 mph)		
4	47 kt (87 km/h; 54 mph)		
Max rate of climb at S/L: 2+2	183 m (600 ft)/min		
135 cdi	200 m (656 ft)/min		
4	264 m (865 ft)/min		
Service ceiling: 2+2	3,660 m (12,000 ft)		
4	4,265 m (14,000 ft)		
T O run: 2+2	235 m (775 ft)		
4	245 m (805 ft)		
135 cdi	440 m (1,443 ft)		

ROBIN DR 400/160 MAJOR

TYPE: Four-seat lightplane.
PROGRAMME: First flight of original DR 400/160 Chevalier 29 June 1972; certified France and UK same year; also marketed under translated name, Knight; Major introduced 1980, being based on DR 400/140B Major 80 with additional cabin windows.
CUSTOMERS: Some 179 built up to 2005; production continues at low rate.
DESIGN FEATURES: Main differences from Dauphin are external baggage compartment door on port side and extended wingroot leading-edges to house additional fuel tanks.
Differences from Dauphin listed below:
POWER PLANT: One 119 kW (160 hp) Textron Lycoming O-320-D2A flat-four engine, driving a Sensenich 740M6S5-2-64 two-blade, fixed-pitch aluminium propeller. Fuel tank in fuselage, capacity 110 litres (29.1 US gallons; 24.2 Imp gallons), and two tanks in wingroot leading-edges, giving total capacity of 190 litres (50.2 US gallons; 41.8 Imp gallons), of which 182 litres (48.1 US gallons; 40.0 Imp gallons) are usable. Provision for auxiliary tank, raising total capacity to 240 litres (63.4 US gallons; 52.8 Imp gallons). Oil capacity 7.6 litres (2.0 US gallons; 1.7 Imp gallons).
ACCOMMODATION: Seating for four persons, on adjustable front seats (maximum load 154 kg; 340 lb total) and rear bench seat (maximum load 154 kg; 340 lb total). Forward-sliding transparent canopy, but port rear window/door provides outside access to baggage area. Up to 40 kg (88 lb) of baggage can be stowed aft of rear seats when four occupants are carried.
AVIONICS: To customer's choice, typically Garmin GNS430 GPS/com/nav/ILS with G1 106 indicator, Bendix/King KX 155 nav/com 2, Bendix/King KI 203 indicator, Garmin GTX 327 transponder, with ACK 30 altitude encoder, and Garmin GMA 340 audio panel.

DIMENSIONS, EXTERNAL:	
Propeller diameter	1.83 m (6 ft 0 in)
Baggage door: Height	0.47 m (1 ft 6½ in)
Width	0.55 m (1 ft 9½ in)



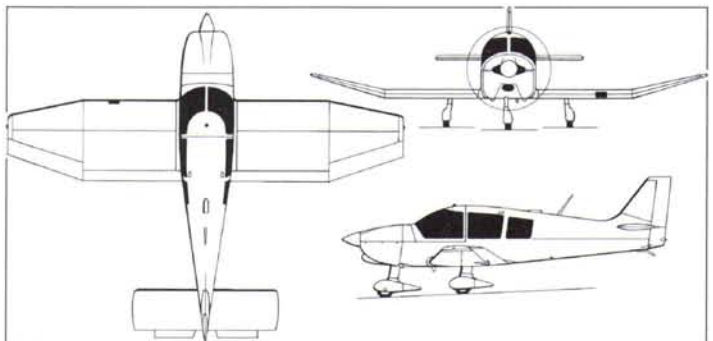
Robin DR 400/160 (*Paul Jackson*)

1128954

AREAS:	
Wings, gross	14.20 m ² (152.8 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped	598 kg (1,318 lb)
Max T-O and landing weight	1,050 kg (2,315 lb)
Max baggage weight	60 kg (132 lb)
Max wing loading	74.0 kg/m ² (15.15 lb/sq ft)
Max power loading	8.81 kg/kW (14.47 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	166 kt (308 km/h; 191 mph)
Max level speed at S/L	146 kt (271 km/h; 168 mph)
Max cruising speed at 75% power at 2,440 m (8,000 ft)	132 kt (245 km/h; 152 mph)
Econ cruising speed at 65% power at 3,200 m (10,500 ft)	130 kt (241 km/h; 150 mph)
Stalling speed: flaps up	56 kt (103 km/h; 64 mph)
flaps down	50 kt (93 km/h; 58 mph)
Max rate of climb at S/L	255 m (836 ft)/min
Service ceiling	4,115 m (13,500 ft)
T-O run	295 m (970 ft)
T-O to 15 m (50 ft)	590 m (1,940 ft)
Landing from 15 m (50 ft)	545 m (1,790 ft)
Landing run	250 m (820 ft)
Range at econ cruising speed, no reserves:	
standard fuel	813 n miles (1,505 km; 935 miles)
optional fuel	1,026 n miles (1,900 km; 1,180 miles)

ROBIN DR 400/180 REGENT

TYPE: Four seat lightplane.
PROGRAMME: First flight (F-WSQO) 27 March 1972; certified 10 May 1972. Later versions with additional cabin windows.
CUSTOMERS: Total 413 built by late 2005, excluding glider tug variants.
DESIGN FEATURES: Generally as for DR 400 series; two-seat rear bench.
Differences from DR 400/160 listed below:
POWER PLANT: One 134 kW (180 hp) Textron Lycoming O-360-A3A flat-four engine driving a Sensenich 76EM8S5-0-64 two-blade, fixed-pitch aluminium propeller. Fuel tankage unchanged.
ACCOMMODATION: Basically as for DR 400/160.
DIMENSIONS, EXTERNAL:
Propeller diameter 1.93 m (6 ft 4 in)
WEIGHTS AND LOADINGS:
Weight empty, equipped 610 kg (1,345 lb)
Max T-O and landing weight 1,100 kg (2,425 lb)
Max wing loading 77.48 kg/m² (15.87 lb/sq ft)
Max power loading 8.21 kg/kW (13.47 lb/hp)
PERFORMANCE (at max T-O weight):
Max level speed at S/L 150 kt (278 km/h; 173 mph)
Max cruising speed at 75% power at 2,285 m (7,500 ft) 140 kt (260 km/h; 162 mph)
Econ cruising speed at 60% power at 3,660 m (12,000 ft) 132 kt (245 km/h; 152 mph)



Robin DR 400/180 Régent (Textron Lycoming O-360-A engine) (Mike Keep) 0507141



Robin DR 400/180 Régent (Paul Jackson)

Stalling speed: flaps up	57 kt (105 km/h; 65 mph)
flaps down	52 kt (95 km/h; 59 mph)
Max rate of climb at S/L	252 m (825 ft)/min
Service ceiling	4,720 m (15,475 ft)
T-O run	315 m (1,035 ft)
T-O to 15 m (50 ft)	515 m (1,690 ft)
Landing from 15 m (50 ft)	530 m (1,740 ft)
Landing run	249 m (820 ft)
Range, no reserves:	
standard fuel	753 n miles (1,395 km; 866 miles)
optional fuel	950 n miles (1,760 km; 1,094 miles)

ROBIN DR 400/180R REMO 180

TYPE: Glider tug.
PROGRAMME: First flight and certification 1972 as DR 400/180R (*Remorqueur*, abbreviated Remo); flown 1985 with Porsche PFM 3200 engine as DR 400RP or Remo 212; became first Porsche-powered aircraft to be certified; Remo 212 production ceased 1990 after 31 had been built, several being subsequently converted with other engines, including DR 400/235 with 175 kW (235 hp) Textron Lycoming IO-540-A4D5 flat-six.
CURRENT VERSIONS: DR 400/180R: As described.
DR 400/180S: As-180R, but with Swiss and German engine silencing modifications.
DR 400/180RP: With 158 kW (212 hp) Porsche PFM 3200 engine.
DR 400/180RD: Lycoming engine and MT-Propeller MTV-22B/174-12 four blade, constant-speed propeller. First aircraft (LN-DFK) built 2003 for Drammen Flyklubb, Norway.
CUSTOMERS: Total 382 Lycoming-engined Remo 180s delivered by late 2004, including 15-180S variants. No production in 2005.
DESIGN FEATURES: Same as Régent, except no external baggage door, and baggage compartment covered in transparent Plexiglas to maximise rearward view; towing hook under tail; Dauphin wing (13.60 m²; 146.4 sq ft) without extended wingroot leading-edges.
Differences from DR 400/180 listed below:
POWER PLANT: One 134 kW (180 hp) Textron Lycoming O-360-A flat-four engine, driving (for glider towing) a Sensenich 76EM8S5-0-58 or Hoffmann HO27HM-180/138 two-blade, fixed-pitch metal propeller. For touring, a coarser pitch Sensenich 76EM8S5-0-64 propeller can be fitted. Fuel 110 litres (29.1 US gallons; 24.2 Imp gallons) normal; additional 50 litre (13.2 US gallon; 11.0 Imp gallon) tank optional.
AVIONICS: Options include S-Tec 30 or S-Tec 55 autopilot, Garmin 150XL GPS, and L-3 Stormscope WX 500 or WX 900.
WEIGHTS AND LOADINGS:
Weight empty, equipped 592 kg (1,305 lb)
Max T-O and landing weight 1,000 kg (2,205 lb)
Max wing loading 73.5 kg/m² (15.05 lb/sq ft)
Max power loading 7.46 kg/kW (12.25 lb/hp)
PERFORMANCE (A: with 300 kg; 661 lb glider. B: with 600 kg; 1,323 lb glider):
Max level speed 146 kt (270 km/h; 168 mph)
Cruising speed at 70% power at FL80 124 kt (230 km/h; 143 mph)
Stalling speed, flaps down: A 47 kt (87 km/h; 54 mph)
B 45 kt (84 km/h; 52 mph)



Robin DR 400/180R Remo 180 glider tug 1128956

Max rate of climb at S/L: A	282 m (925 ft)/min
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B	210 m (690 ft)/min
Service ceiling	6,100 m (20,000 ft)
T-O run: A	205 m (675 ft)
B	300 m (985 ft)
T-O to 15 m (50 ft): A	400 m (1,315 ft)
B	470 m (1,545 ft)
Landing from 15 m (50 ft)	470 m (1,545 ft)
Range, 65% power at best altitude, no reserves:	
max normal fuel	494 n miles (915 km; 568 miles)
with supplementary fuel	1,026 n miles (1,900 km; 1,180 miles)

ROBIN DR 400/200R REMO 200

TYPE: Glider tug.
PROGRAMME: Prototype (F-ZWWX) flown 1993.
CUSTOMERS: Total 14 built, excluding one conversion, up to 2001. None in following four years.
Differences from DR 400/180R listed below:
POWER PLANT: One 149 kW (200 hp) Textron Lycoming IO-360 flat-four engine, driving a constant-speed propeller.
WEIGHTS AND LOADINGS:
Weight empty, equipped 650 kg (1,433 lb)
Max T-O and landing weight 1,100 kg (2,425 lb)
Max wing loading 77.5 kg/m² (15.87 lb/sq ft)
Max power loading 7.38 kg/kW (12.12 lb/hp)
PERFORMANCE (A: with 300 kg; 661 lb glider, B: with 600 kg; 1,323 lb glider):
Cruising speed at 75% power 135 kt (250 km/h; 155 mph)
Max rate of climb at S/L: A 312 m (1,024 ft)/min
B 258 m (846 ft)/min
T-O to 15 m (50 ft): A 400 m (1,312 ft)
B 415 m (1,362 ft)
Landing from 15 m (50 ft) 415 m (1,362 ft)
Range, no reserves:
max normal fuel 447 n miles (828 km; 514 miles)
with supplementary fuel 610 n miles (1,130 km; 702 miles)



Robin DR 400/200R Remo glider tug (Paul Jackson)

ROBIN DR 500 PRESIDENT

TYPE: Four-seat lightplane.
PROGRAMME: Prototype (F-WZZY), then known as DR 400/200i, first flew 5 June 1997; revealed at Paris Air Show, 13 June. Renamed as above but certified as DR 400/500.



Robin DR 500/200i Président (Paul Jackson)

CURRENT VERSIONS: DR 500/200i Président: As described.
DR 500 Super Régent: 180 hp engine, lacks fuel injection. None built.
DR 500C: Prototype, F-WZZY (c/n 27), flown in 2002 with 134 kW (180 hp) Textron Lycoming O-360 and Sensenich metal, fixed-pitch propeller of 1.63 m (5 ft 4 in) diameter — which may be reduced to 1.57 m (5 ft 4 in) on production version. Total of some 300 hours flown by mid-2004, although certification then still under way. Optimised for flying schools requiring upgrade from DR 400; has DR 500's wider fuselage, but economies and simplicity of carburettor and fixed-pitch propeller.
CUSTOMERS: Deliveries began in 1998 with eight aircraft. Total 40 built by mid-2002 for owners in France, Germany, New Zealand, Spain, Switzerland and UK; none further until 41st delivered on 27 October 2005 to UK owner.
DESIGN FEATURES: Up-rated version of DR 400/180 Régent, including that version's 14.20 m² (152.8 sq ft) wing; 149 kW (200 hp) Textron Lycoming IO-360-A1B6 engine driving a Hartzell F7 666A-2 constant-speed propeller; width of cabin increased by 10 cm (4 in) and headroom by same amount; IFR instrumentation as standard; Honeywell avionics, including KAP 140 autopilot. Fuel capacity increased. Flaps electrically operated.
Differences from DR 400/180 listed below:
LANDING GEAR: Nosewheel size 15 x 6.00-5, maximum pressure 1.8 bar (26 lb/sq in); mainwheel size 330x150, pressure 2.0 bar (29 lb/sq in). Cleveland disc brakes.
POWER PLANT: One 149 kW (200 hp) Textron Lycoming IO-360-A1B6 driving a Hartzell two-blade, constant-speed metal propeller. Fuel contained in four tanks: two, each of capacity 40 litres (10.6 US gallons; 8.8 Imp gallons), in wingroots; main tank, capacity 105 litres (27.7 US gallons; 23.1 Imp gallons), below cabin floor; and fourth tank, capacity 90 litres (23.8 US gallons; 19.8 Imp gallons), below baggage compartment. Total capacity of 275 litres (72.6 US gallons; 60.5 Imp gallons).
ACCOMMODATION: Four adults, or two plus three children on fore-and-aft adjustable leather seats. Baggage shelf at rear of seats; upward-opening rear window on port side doubles as external access to baggage compartment.
AVIONICS: To customer's choice, typically Bendix/King KX 155 nav/com, KI 208 VOR/LOC indicator, KT 76C transponder with ACK 30 altitude encoder, Garmin 150 XL GPS, and SPA 400 intercom system, four microphone and headset jack plugs, and PTT switch on each control stick. Options include S-Tec 30 or S-Tec 55 autopilot and L-3 Stormscope WX 500 or WX 900.
Instrumentation: As for DR 400/180 except: dual altimeters, fuel flow/manifold pressure gauge, four fuel quantity gauges, and ammeter, all standard. Sandel Electronics HIS optional.
EQUIPMENT: Electric rudder trim, alternate static source, and three strobe lights (on upper fuselage and at wingtips), all standard.
DIMENSIONS, EXTERNAL:
Length overall 7.22 m (23 ft 8¼ in)
Propeller diameter 1.88 m (6 ft 2 in)
DIMENSIONS, INTERNAL:
Cabin max width 1.20 m (3 ft 11¼ in)
WEIGHTS AND LOADINGS:
Weight empty 560 kg (1,235 lb)
Baggage capacity 60 kg (132 lb)
Max T-O weight 1,059 kg (2,335 lb)
Max wing loading 74.6 kg/m² (15.28 lb/sq ft)
Max power loading 7.11 kg/kW (11.68 lb/hp)
PERFORMANCE:
Max level speed 147 kt (272 km/h; 163 mph)
Cruising speed at 75% power 143 kt (265 km/h; 165 mph)
Max rate of climb at S/L 255 m (837 ft)/min
T-O to 15 m (50 ft) 463 m (1,520 ft)
Landing from 15 m (50 ft) 530 m (1,739 ft)
Range, standard fuel, no reserves:
at 75% power 995 n miles (1,842 km; 1,145 miles)
at 65% power, best altitude 1,001 n miles (1,855 km; 1,152 miles)

SAUPER

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The company was purchased by ALMS on 1 February 2006 and details of its two designs can be found under that entry in *Jane's All the World's Aircraft*.

SKYDESIGN

GECI INTERNATIONAL

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Formed in 1979, GECI International is a transport-orientated engineering and consulting company with a staff of 400. It has contributed to the Fairchild Dornier 728 and various business jet and Airbus airliner programmes. In 2001, it formed Skydesign SAS to develop the Skylander transport, formal launch of which was then intended to take place in the second half of 2003.

Launch failed to take place, but in mid-2006 GECI was assembling USD160 million from private and government investors to establish production plant at Evora, Portugal.

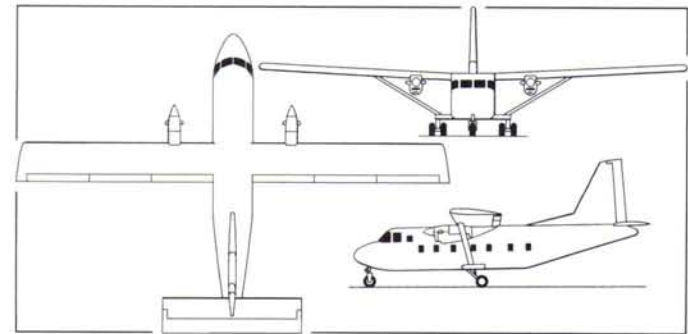
SKYDESIGN SB100 SKYLANDER

TYPE: Twin-turboprop light transport.
PROGRAMME: Announced 17 October 2001 at Seoul Air Show. Design supervision by the late Desmond Norman, co-designer of the BNG Islander. First metal scheduled to be cut in January 2004; first of two prototypes expected to fly in May 2005, but this postponed until at least 2007. First deliveries two years after initial flight.
Programme structured for joint funding (initially USD120 million) by three risk-sharing partners, Korean Aerospace Industries being first, on 17 October 2001, to pledge USD30 million to secure responsibility for wing production.
CURRENT VERSIONS: **Skylander**: As described. Freighter, passenger and maritime patrol versions.
Skylander L: Lightened version with 559 kW (750 shp) PT6A engines, 2,000 kg (4,400 lb) payload and reduced price.
COSTS: Estimated USD3.6 million unit cost for 'green' airframe; estimated direct operating cost USD435 per hour, based on annual utilisation of 1,500 flying hours (both 2003). Break-even estimated at 115 airframes. Sales goal over 20 years is some 1,300, being equivalent to 30 per cent of estimated market for 4,485 aircraft in this class.
DESIGN FEATURES: Intended for operation from rough airfields with minimal maintenance facilities. Fixed landing gear and conventional alloy structure; unpressurised. Certifiable to FAR Pt 23.
Fuselage of square cross-section, with upswept rear; tailplane at base of fin. High wing with single bracing strut each side.
Wing section NACA 23015.
FLYING CONTROLS: Conventional and manual, by cable. Electrically actuated flaps. Horn-balanced rudder.
STRUCTURE: Principally of aluminium alloy.



Artist's impression of Skydesign Skylander

1159800



Provisional general arrangement of Skydesign SB100 Skylander
(Paul Jackson)

1159831

LANDING GEAR: Tricycle type; fixed. Twin mainwheels mounted on sponsons. Single, steerable nosewheel. Tyre size 8.50-10 (all).
POWER PLANT: Two Pratt & Whitney Canada PT6A-65B turboprops, each 820 kW (1,100 shp), driving Hartzell five-blade propellers. Fuel contained in two integral wing tanks, combined capacity 3,285 litres (868 US gallons; 723 Imp gallons).
ACCOMMODATION: Two pilots; 18 passengers (two plus one abreast) and one cabin attendant. Alternative combi (nine to 12 passengers ahead of LD3 container and separated by 9 g bulkhead) and all-freight configurations. Latter include three LD3s plus 4.0 m³ (141 cu ft) to rear; and four 1.83 x 1.40 m (72 x 55 in) pallets plus 5.4 m³ (191 cu ft). Baggage hold beneath flight deck.
Crew door forward, port; double freight door (divided vertically, with forward- and rearward-opening elements) rear, port.
SYSTEMS: Electrical system includes 28 V 3004 starter/generator. Hydraulic system for brakes and nosewheel steering. Wing and tail surface leading-edges de-iced by pneumatic boots.
AVIONICS: Bendix /King avionics fit, with EFIS display.
DIMENSIONS, EXTERNAL:
Wing span 21.60 m (70 ft 10½ in)
Wing chord, constant 2.00 m (6 ft 6¾ in)
Wing aspect ratio 10.9
Length overall 14.78 m (48 ft 6 in)
Height overall 6.15 m (20 ft 2 in)
Tailplane span 6.92 m (22 ft 8½ in)
Tailplane chord, constant 1.46 m (4 ft 9½ in)
Wheel track (c/l shock-absorbers) 3.47 m (11 ft 4½ in)
Wheelbase 5.85 m (19 ft 2¼ in)
Propeller diameter 2.82 m (9 ft 3 in)
Distance between propeller centres 5.66 m (18 ft 6¾ in)
DIMENSIONS, INTERNAL:
Hold: Length: parallel section 5.64 m (18 ft 6 in)
total flat floor 6.17 m (20 ft 3 in)
Width: max 1.94 m (6 ft 4½ in)
mean 1.88 m (6 ft 2 in)
at floor 1.83 m (6 ft 0 in)
Max height 1.83 m (6 ft 0 in)
Volume 28.0 m³ (989 cu ft)
Baggage hold volume 0.85 m³ (30.0 cu ft)
AREAS:
Wings, gross 42.63 m² (458.9 sq ft)
WEIGHTS AND LOADINGS:
Max payload 3,300 kg (7,275 lb)
Max fuel weight 2,450 kg (5,401 lb)
Max T-O and landing weight 8,390 kg (18,496 lb)
Max ramp weight 8,440 kg (18,607 lb)
Max wing loading 196.8 kg/m² (40.31 lb/sq ft)
Max power loading 5.12 kg/kW (8.41 lb/shp)
PERFORMANCE (estimated):
Cruising speed: max 231 kt (428 km/h; 266 mph)
econ 190 kt (352 km/h; 219 mph)
Max rate of climb at S/L 610 m (2,000 ft)/min
Rate of climb at S/L, OEI 183 m (600 ft)/min
T-O run 420 m (1,378 ft)
T-O to 11 m (35 ft) 550 m (1,805 ft)
Landing run 385 m (1,263 ft)
Landing from 15 m (50 ft) 690 m (2,265 ft)
Range:
with max fuel 1,200 n miles (2,222 km; 1,381 miles)
with max payload 150 n miles (277 km; 172 miles)

SOCATA

SOCATA SOCIÉTÉ DE CONSTRUCTIONS D'AVIONS DE
TOURISME ET D'AFFAIRES
(SUBSIDIARY OF EADS)

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Formed 1966 as a subsidiary of Aerospatiale responsible for light aircraft. Produces TBM700 utility turboprop, but terminated manufacture of TB series of lightplanes in 2003, except for special orders. In 1999, sold and delivered 40 TBs; sold 16 and delivered 21 TBM 700s. Reduced deliveries of 45 TBs and 33 TBMs in 2000; target for 2001 was 100+ and 33, respectively, but 63 and 33 actually achieved; 2002 deliveries totalled 70 TBs and 34 TBMs, 2003 totalled 40 and 34; 2004 totalled five and 31, and 2005 totalled nine and 31.

Also makes components for Airbus A300/320/330/340/380/400M, Lockheed Martin C-130, ATR 42/72, Dassault Falcons, including 7X, Eurocopter Super Puma, Dauphin, Ecureuil and EC 130, and Embraer 170 and 190, satellite structures. Covered floor area 80,000 m² (861,100 sq ft); workforce in 2004 was 1,060. Turnover in 2004 was EUR174 million.

Following formation of EADS on 10 July 2000, Socata is 100 per cent owned by that company.

SOCATA TB 9 TAMPICO, TB 10 and TB 200 TOBAGO GT

TYPE: Four-seat lightplane.

PROGRAMME: Design of original TB series launched 1975; first flight of original TB 10 (F-WZJP), powered by 119 kW (160 hp) Textron Lycoming O-320, 23 February 1977; second prototype powered by 134 kW (180 hp) Textron Lycoming.

In June 1999, Socata announced its Nouvelle Génération (New Generation) series of single piston-engined models. The title Generation Two (GT) was subsequently adopted. These featured aerodynamic and other improvements that may subsequently be incorporated in the Socata MS diesel-engined light aircraft described elsewhere in this entry. Modifications included a curved dorsal fairing for the fin, upturned wingtips, raised cabin roofline with new single-piece carbon fibre/honeycomb roof, revised window pillar design, flush-mounted windows, larger baggage door, redesigned interior and new fuel filler door. From 201st TB in mid-2003 (TB 10 F-GOIH c/n 2200, displayed at Paris, 15 to 22 June 2003) all aircraft fitted with Moritz engine control panel.

The TB9C Tampico Club, TB 9 Sprint, TB 10 Tobago, TB 10 Tobago Privilège and TB 200 Tobago XL are now out of production, having been replaced in February 2000 by the GT series. Production of this version was drastically curtailed at the end of 2003, although a few were built in 2004 and 2005 to meet specific orders.

CURRENT VERSIONS: **TB 9 Tampico Sprint GT:** Baseline model, 119 kW (160 hp) Textron Lycoming O-320-D2A flat-four engine driving a Sensenich two-blade fixed-pitch metal propeller. Fuel capacity 158 litres (41.7 US gallons; 34.8 Imp gallons), of which 152 litres (40.2 US gallons; 33.4 Imp gallons) are usable. Oil capacity 8 litres (2.1 US gallons; 1.8 Imp gallons).

TB 10 Tobago GT: 134 kW (180 hp) Textron Lycoming O-360-A1AD flat-four engine. Detailed description applies to this version.

TB 200 Tobago GT: Similar to TB 10 Tobago GT, but with 134 kW (180 hp) fuel-injected Textron Lycoming IO-360-A1B6 engine

CUSTOMERS: Total of 468 Tampicos and Tampico Clubs in service by June 1999 with customers in Africa and Middle East, Asia-Pacific, Australasia, Europe, and North America. Total of 637 Tobagos and 87 Tobago XLs delivered by June 1999, to customers in Africa and Middle East, Australasia, Europe, North America and elsewhere. Production of first-generation TBs (9, 10, 200, 20 and 21) totalled 1,928, including prototypes.

Recent customers include the Indonesian Navy, which ordered five Tobago GTs in February 2004, of which two were scheduled for delivery in June 2004 and the remainder in early 2005.

TB GT PRODUCTION 2000-2004

TB 9 Tampico GT	7
TB 10 Tobago GT	20
TB 200 Tobago GT XL	21
TB 20 Trinidad GT	124
TB 21 Trinidad GT TC	49
Untraced	6
Prototype (TB 20)	1
Total	228¹

¹ Plus small-scale production in 2005

TAMPICO AND TOBAGO GT DELIVERIES

Year	TB 9 GT	TB 10 GT	TB 200 GT
2000	2	1	nil
2001	2	8	8
2002	3	7	2
2003	2	7	3
2004	nil	3	nil
2005	1	4	nil

DESIGN FEATURES: Conventional light tourer and trainer.

Wing section RA 16.3C3; thickness/chord ratio 16 per cent; dihedral 4° 30'.

FLYING CONTROLS: Manual, with pushrod actuation for ailerons, rudder and all-moving tailplane; cable-actuated anti-balance tab on tailplane, plus ground-adjustable tabs on

ailerons and rudder; strakes on lower edges of fuselage just aft of wing control turbulence under rear fuselage; electrically actuated flaps.

STRUCTURE: Conventional light alloy; single-spar wing; GFRP tips, engine cowlings, cabin roof structure and dorsal strake. Triple anti-corrosion protection.

LANDING GEAR: Non-retractable tricycle type. Wing-mounted, trousered, cantilever main legs with integral oleo-pneumatic shock absorbers and trailing-link suspension; steerable nosewheel, oleo-pneumatic shock absorber; glass fibre wheel fairings on all three units. Mainwheel tyres size 6.00-6 (6 ply), pressure 2.30 bar (33 lb/sq in) on TB 10 GT/200 GT; 15x6.00-6 (6 ply) on TB 20 GT/21 GT. Nosewheel 5.00-5 on TB 10 GT/200 GT and 5.00-4 on TB 20 GT/21 GT. Hydraulic disc brakes. Parking brake.

POWER PLANT: One 134 kW (180 hp) Textron Lycoming O-360-A1AD flat-four engine, driving a Hartzell two-blade constant-speed propeller. Two integral fuel tanks in wing leading-edges; total capacity 210 litres (55.5 US gallons; 46.2 Imp gallons), of which 204 litres (53.9 US gallons; 44.9 Imp gallons) are usable. Oil capacity 8 litres (2.1 US gallons; 1.8 Imp gallons).

ACCOMMODATION: Four or five seats in enclosed cabin, with dual controls. Separate, adjustable front seats with inertia reel seat belts. Two separate rear seats or removable three-place bench seat with safety belts. Sharply inclined low-drag windscreen. Access via upward-hinged window/doors of glass fibre. Baggage compartment aft of cabin, with external door on port side. Cabin carpeted, soundproofed, heated and ventilated. Windscreen defrosting standard.

SYSTEMS: Electrical system includes 28 V 70 A alternator and 24 V 10 A battery. Hydraulic system for brakes only.

AVIONICS: Honeywell Silver Crown avionics suite to customer choice, including Bendix/King KLN 90 GPS.

Instrumentation: Typical IFR package includes dual altimeters; dual true airspeed indicators; dual artificial horizons; vertical speed indicator, electric turn co-ordinator; directional gyro, tachometer; oil temperature, oil pressure, fuel pressure, fuel quantity, manifold pressure, CHT/EGT and OAT gauges; ammeter, voltmeter and compass.

EQUIPMENT: Includes armrests for all seats, map pockets, anti-glare visors, stall warning indicator, tie-down fittings and towbar, landing and navigation lights, four individual cabin lights and instrument panel lighting.

DIMENSIONS, EXTERNAL (TB 9 GT, TB 10 GT and TB 200 GT):

Wing span	10.01 m (32 ft 10 in)
Wing chord, constant	1.22 m (4 ft 0 in)
Wing aspect ratio	8.0
Length overall: TB 9 GT	7.72 m (25 ft 4 in)
TB 10 GT/200 GT	7.75 m (25 ft 5 in)
Height overall	3.02 m (9 ft 11 in)
Tailplane span	3.20 m (10 ft 6 in)
Wheel track	2.30 m (7 ft 6½ in)
Wheelbase	1.96 m (6 ft 5 in)
Propeller diameter	1.88 m (6 ft 2 in)
Propeller ground clearance	0.10 m (4 in)
Cabin doors (each): Width	0.90 m (2 ft 11½ in)
Height	0.76 m (2 ft 6 in)
Baggage door: Width	0.64 m (2 ft 1¼ in)
Max height	0.53 m (1 ft 9 in)

DIMENSIONS, INTERNAL (TB 9, TB 9C, TB 10 and TB 200):

Cabin:	
Length: firewall to rear bulkhead	2.53 m (8 ft 3½ in)
panel to rear bulkhead	2.00 m (6 ft 6¾ in)
Max width: at rear seats	1.28 m (4 ft 2¼ in)
at front seats	1.15 m (3 ft 9¼ in)
Max height	1.20 m (3 ft 11¼ in)

AREAS (TB 9 GT, TB 10 GT and TB 200 GT):

Wings, gross	11.90 m ² (128.1 sq ft)
Ailerons (total)	0.91 m ² (9.80 sq ft)
Trailing-edge flaps (total)	3.72 m ² (40.04 sq ft)
Fin	0.88 m ² (9.47 sq ft)
Rudder	0.63 m ² (6.78 sq ft)
Horizontal tail surfaces (total)	2.56 m ² (27.56 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, with unusable fuel and oil:	
TB 9 GT	684 kg (1,508 lb)
TB 10 GT	730 kg (1,609 lb)
TB 200 GT	745 kg (1,642 lb)
Baggage: all	65 kg (143 lb)
Max T-O weight: TB 9 GT	1,060 kg (2,336 lb)
TB 10 GT, TB 200 GT	1,150 kg (2,535 lb)
Max wing loading: TB 9 GT	89.1 kg/m ² (18.25 lb/sq ft)
TB 10 GT, TB 200 GT	96.6 kg/m ² (19.79 lb/sq ft)
Max power loading: TB 9 GT	8.91 kg/kW (14.64 lb/hp)
TB 10 GT	8.57 kg/kW (14.08 lb/hp)
TB 200 GT	7.72 kg/kW (12.68 lb/hp)

PERFORMANCE:

Max cruising speed:	
TB 9 GT at 70% power at FL60	115 kt (213 km/h; 132 mph)
TB 10 GT at 75% power at FL60	127 kt (235 km/h; 146 mph)
TB 200 GT at 75% power at FL85	130 kt (240 km/h; 149 mph)

Econ cruising speed:	
TB 9 GT at 65% power at FL80	105 kt (194 km/h; 121 mph)
TB 10 GT at 60% power at FL80	109 kt (202 km/h; 125 mph)
TB 200 GT at 60% power at FL85	115 kt (213 km/h; 132 mph)

Stalling speed:	
flaps up: TB 9 GT	58 kt (107 km/h; 67 mph)
TB 10 GT	61 kt (112 km/h; 70 mph)
flaps down: TB 9 GT	48 kt (89 km/h; 56 mph)
TB 10 GT	52 kt (97 km/h; 60 mph)
TB 200 GT	53 kt (98 km/h; 61 mph)

Max rate of climb at S/L: TB 9 GT	203 m (665 ft)/min
TB 10 GT	240 m (787 ft)/min
TB 200 GT	286 m (937 ft)/min

Max certified altitude: TB 9 GT	3,350 m (11,000 ft)
TB 10 GT	3,965 m (13,000 ft)
TB 200 GT	4,875 m (16,000 ft)

T-O to 15 m (50 ft):	
TB 9 GT	570 m (1,870 ft)
TB 10 GT	505 m (1,657 ft)
TB 200 GT	475 m (1,558 ft)
Landing from 15 m (50 ft): TB 9 GT	420 m (1,378 ft)

TB 10 GT	460 m (1,509 ft)
TB 200 GT	449 m (1,473 ft)
Max range: TB 9 GT	564 n miles (1,046 km; 650 miles)
TB 10 GT	697 n miles (1,290 km; 802 miles)
TB 200 GT	637 n miles (1,179 km; 733 miles)

SOCATA TB 20 and TB 21 TRINIDAD

TYPE: Four-seat lightplane.

PROGRAMME: First flight TB 20 (F-WDBA) 14 November 1980; French certification 18 December 1981; FAA certification 27 January 1984; first delivery (F-WDBB) 23 March 1982; first flight TB 21, 24 August 1984; French certification 23 May 1985; FAA certification 5 March 1986.

Earlier TB 20 Trinidad, TB 20 Trinidad Excellence, TB 20 C and TB 21 Trinidad TC variants (of which some 700 built) no longer in production. TB 20 Trinidad GT and TB 21 Trinidad GT TC continued in production until 2003, although remaining available to special order. Total of at least 126 TB 20 GTs and 49 TB 21 GTs built.

CURRENT VERSIONS: **TB 20 Trinidad GT:** At the Paris Air Show in June 1999, Socata announced its Nouvelle Génération (New Generation) series of single piston-engined aircraft, the prototype of which, TB 20 NG F-WWRG, had first flown on 21 April 1999. The title Generation Two (GT) was subsequently adopted. The TB 20 GT received DGAC certification on 31 January 2000. The GT series was formally launched at Tarbes on 2 February 2000 with roll-out of the first production TB 20 GT, which became US demonstrator (N163GT c/n 2000) and was exhibited at Sun 'n' Fun, April 2000.

GT variants feature aerodynamic and other improvements that will be incorporated in the Socata Morane diesel-engined series described below. Identifying features include upturned wingtip, similar to those on the TBM 700 turboprop; a curved dorsal fillet; raised cabin roofline with new single-piece carbon fibre/honeycomb roof; revised cabin window/pillar design with flush-mounted windows; plus redesigned interior, larger baggage door, new fuel filler door, retractable footstep and optional three-blade Hartzell propeller.

In June 2003, Socata launched **Premium 2003** version of TB 20 Trinidad GT with additional features as standard, including Hartzell Scimitar propeller (with liquid de-icing), Garmin GNS 530 VHF/VOR/ILS/GPS, GNS 430, GTX 327 transponder and Bendix/King KFC 225 autopilot.

TB 21 Trinidad GT TC: As above, but with computer-controlled turbocharger. **Premium 2003** version launched at Paris in June 2003, with standard features as for concurrent TB 20.

CUSTOMERS: At time of launch of GT series, the Aeronautical Academy of Europe in Evora, Portugal, took options on four TB 20 GTs. By mid-2000, TB 20 GTs had been delivered to customers in France, UK and USA from planned first year production of 72. Orders in 2000 included 69 from New Avex, distributor for US West Coast; early customers included the Nigerian College of Aviation Technology (NCAT) of Zaria, Kaduna State, which ordered 10 Trinidad GTs for delivery beginning mid-2001 and French training school SEFA, which ordered 10 TB 20 GTs in June 2002, of which the first four were delivered in July 2002.

TRINIDAD DELIVERIES		
Year	TB 20 GT	TB 21 GT
2000	30 ¹	12 ¹
2001	33	12
2002	44	14
2003	19	9
2004	2	nil
2005	1	3

¹ Approximately

DESIGN FEATURES: Mainly as for Tobago; dihedral 6° 30'.

FLYING CONTROLS: As Tobago, but rudder trim and flap preselector added.

STRUCTURE: Largely as Tobago.

LANDING GEAR: Hydraulically retractable tricycle type, with single wheel on each unit. Free-fall emergency extension. Steerable nosewheel retracts rearward. Main units, with trailing-link suspension, retract inward into fuselage. Hydraulic disc brakes. Parking brake.

POWER PLANT: **TB 20 GT:** One 186 kW (250 hp) Textron Lycoming IO-540-C4D5D flat-six, driving a two-blade Hartzell constant-speed propeller.

TB 21 GT: One 186 kW (250 hp) Textron Lycoming TIO-540-AB1AD turbocharged flat-six. Two-blade Hartzell constant-speed propeller; three-blade propeller optional.

Fuel in two integral wing tanks, total capacity 336 litres (88.8 US gallons; 73.9 Imp gallons), of which 326 litres (86.1 US gallons; 71.7 Imp gallons) usable. Oil capacity 12.6 litres (3.3 US gallons; 2.8 Imp gallons).

ACCOMMODATION: Generally as for TB 9 Sprint GT, TB 10 Tobago GT and TB 200 XL GT; new headrests for all seats introduced on GT variants; rear seat can be removed for carrying 250 kg (551 lb) of cargo.

SYSTEMS: Electrical system comprises 28 V 70 A alternator and 24 V 10 Ah battery.

AVIONICS: TB 20/21 GT basic navigation package comprises single nav/com and VOR receiver, IFR packages and EFIS optional.

SPECIFICATIONS:

DIMENSIONS, EXTERNAL: As for TB 10 GT, except:

Wing span 9.97 m (32 ft 8½ in)

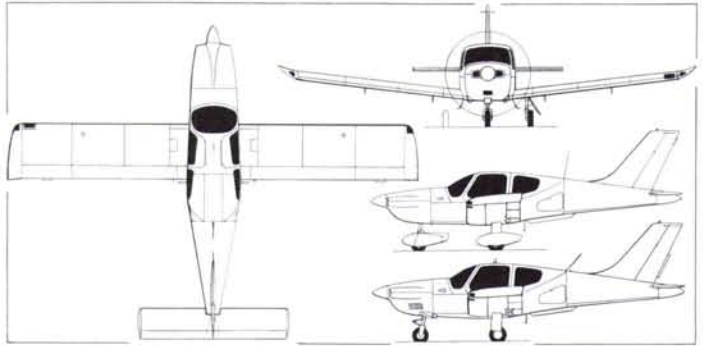
Wing aspect ratio 8.2

Length overall 7.75 m (25 ft 5 in)

Height overall 2.85 m (9 ft 4¼ in)



Socata TB 21 Trinidad GT TC from 2003 production (Paul Jackson) 1128904



Socata TB 21 Trinidad GT, with additional side view (upper) of TB 10 Tobago GT (Dennis Punnett) 0110866

Tailplane span	3.68 m (12 ft 0¾ in)
Wheel track	2.17 m (7 ft 1½ in)
Wheelbase	1.91 m (6 ft 3¼ in)
Propeller diameter	2.03 m (6 ft 8 in)
DIMENSIONS, INTERNAL (TB 20 GT):	
Cabin: Width	1.28 m (4 ft 2½ in)
Max height	1.20 m (3 ft 11¼ in)
AREAS: As for TB 10 GT, except:	
Horizontal tail surfaces (total)	3.06 m ² (32.94 sq ft)
WEIGHTS AND LOADINGS:	
Operating weight empty: TB 20 GT	800 kg (1,764 lb)
TB 21 GT	867 kg (1,911 lb)
Max baggage: TB 20 GT, TB 21 GT	65 kg (143 lb)
Max T-O and landing weight:	
TB 20 GT, TB 21 GT	1,400 kg (3,086 lb)
Max wing loading:	
TB 20 GT, TB 21 GT	117.6 kg/m ² (24.10 lb/sq ft)
Max power loading:	
TB 20 GT, TB 21 GT	7.51 kg/kW (12.35 lb/hp)
PERFORMANCE:	
Cruising speed at 75% power:	
TB 20 GT at FL65	163 kt (302 km/h; 188 mph)
TB 21 GT at FL250	190 kt (352 km/h; 219 mph)
Econ cruising speed at 65% power:	
TB 20 GT at FL85	150 kt (278 km/h; 173 mph)
TB 21 GT at FL250	169 kt (313 km/h; 194 mph)
Rate of climb at S/L: TB 20 GT	366 m (1,200 ft)/min
TB 21 GT	344 m (1,130 ft)/min
TB 21 GT at FL170	244 m (800 ft)/min
Certified ceiling: TB 20 GT	6,100 m (20,000 ft)
TB 21 GT	7,620 m (25,000 ft)
T-O to 15 m (50 ft): TB 20 GT	595 m (1,955 ft)
TB 21 GT	595 m (1,955 ft)
Landing from 15 m (50 ft):	
TB 20 GT, TB 21 GT	540 m (1,775 ft)
Max range:	
TB 20 GT	1,100 n miles (2,037 km; 1,265 miles)
TB 21 GT	1,035 n miles (1,916 km; 1,191 miles)

SOCATA TBM 700

TYPE: Business turboprop.

PROGRAMME: Since early 2006, all TBM 700 production has been of the 700N version, which is marketed as the TBM 850 and described separately. Further TBM 700s will be produced only if Socata receives sufficient orders to initiate production of a commercially viable batch.

SOCATA TBM 850

Engineering designation: **TBM 700N**

TYPE: Business turboprop.

PROGRAMME: TBM 850 programme began August 2004; first flown February 2005 as conversion of second TBM 700 prototype F-WKPG. Eight-month trial programme of 103 sorties and 162 hours; EASA certification November 2005. Version publicly announced 13 December 2005. FAA certification 23 January 2006. First production aircraft F-WWRE/N850TB flew 23 January 2006.

TBM 700 originated in collaborative project by Socata (70 per cent) and Mooney of the US (30 per cent), launched 12 June 1987 by TBM SA company. Valmet of Finland joined in June 1988, but withdrew in the following year. Socata responsible for technical development and certification, plus manufacture of forward fuselage and empennage; Mooney assigned rear fuselage and wings and intended US production line but withdrew in 1991.

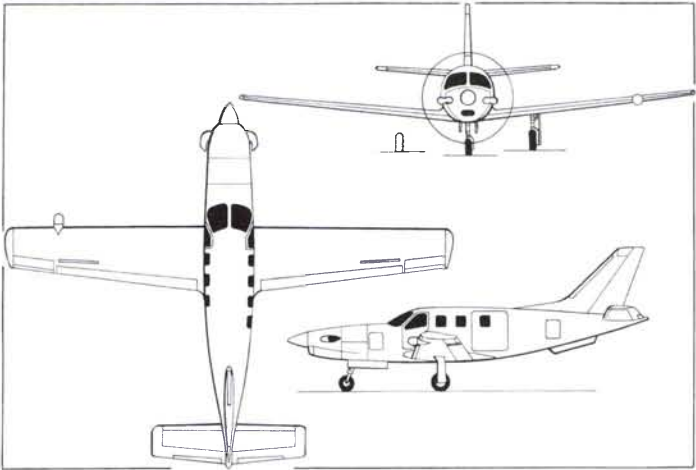
Three prototypes built: first flights 14 July 1988 (F-WTBM), 3 August 1989 (F-WKPG) and 11 October 1989 (F-WKDL); French certification received 31 January 1990; FAR Pt 23 type approval awarded 28 August 1990; first delivery 21 December 1990; Canadian public transport certification 1993. Wider, single-piece, upward-opening door replaced horizontally split door, port side, rear, from late 1998 and is standard. Aircraft optimised for freighting (TBM 700B) have optional crew door, port, forward. Increased weight version (TBM 700C2) announced late 2002 and achieved FAR 23 certification on 7 March 2003, followed by Brazilian approved on 7 February 2005 and Civil Aviation Safety Authority of Australia (CASA) certification on 9 September 2005.

CURRENT VERSIONS: **TBM 850:** Engineering designation TBM 700N (Mod 70-0188-00). Up-rated version of TBM 700C, of which first of two prototypes (c/n 205 F-WWRL/N778C) flew February 2002; officially announced 10 September 2002 at NBAA Convention, Orlando, Florida; second aircraft (c/n 240 F-WWRO/N811SW) followed as a 700C2. Changes included option of increased (TBM 700C2) or original (TBM 700C1) MTOW.



Socata TBM 850 business turboprop (Paul Jackson)

1040403



General arrangement of Socata TBM 850 (James Goulding)

1158280

according to local certification rules; strengthened spar box and wing attachments; stronger wheels and 10-ply tyres; additional (unpressurised) baggage compartment to rear of cabin; new interior with 20g seats; improved air conditioning. Sole variant from late 2002; first production 700C1 was c/n 244 (F-WWR1/N700DY); first production 700C2 c/n 245 (F-WWRM/N6750Y) completed November 2002. All aircraft had structural and interior modifications, but 700C1 retained original seats (not 20g) and landing gear; later upgrade to 700C2 is possible from c/n 299 onwards (278th production); all TBM 700Cs RVSM-approved on delivery.

A quick-change air ambulance installation for the TBM 700C2 was introduced at the NBAA Convention in Las Vegas on 12 October 2004, featuring the Lifeport Inc AeroSled PLUS (Patient Loading Utility System) self-contained module with full life-support capability. AeroSled PLUS weighs less than 72.6 kg (160 lb) and mounts directly to existing hardpoints and tracks via a loading ramp that enables the patient to be loaded at door level, requiring no lifting once inside the aircraft. Total fleet time (270 aircraft) stood at more than 380,000 hours in June 2005.

CUSTOMERS: Total three prototypes and 348 production TBM 700s delivered by October 2006, including 217 700/700Bs and 107 700Cs. TBM 850 introduced at 325th production (c/n 346); 25 delivered by October 2006, at which time further 45 on order.

Deliveries of TBM 700 to French Air Force began 27 May 1992 with first of initial six for liaison duties with Groupe Aérien d'Entraînement et de Liaison (GAEL) and ETE 43; further six supplied 1993-94 (also for ETE 41 and ETE 44, plus CEAM); total Air Force requirement is 22 (of which 17 funded by mid-1998); two officially handed over to French Air Force 13 January 1995 for 3 GHL at Rennes, followed by six more, last three of which delivered (in TBM 700B configuration) 28 June 2000. Total of 24 delivered in 2000, 33 in 2001, 34 in 2002, 34 in 2003, 31 in 2004 and 31 in 2005. Recent production almost totally to US.

COSTS: USD2.576 million, basically equipped; USD2.800 million with typical avionics (2006).

DESIGN FEATURES: TBM 850 version primarily intended for US market, in competition with new generation of very light personal jets. Max cruising speed at FL260 increased by 20 kt (37 km/h; 23 mph) from TBM 700's 300 kt (556 km/h; 345 mph); time to FL260 reduced by 9 minutes from TBM 700's 24 minutes.

Conceived (TBM 700) as high-speed, long-range, single-turboprop business transport. Low wing; twin strakes under rear fuselage; sweptback fin (with dorsal fin) and mass balanced rudder; non-swept tailplane with mass balanced elevators. Airframe life 12,000 cycles/16,000 hours from TBM 700C.

Wing of Aerospatiale RA 16-43 root section with 6° 30' dihedral from roots. **FLYING CONTROLS:** Conventional and manual. Pushrod and cable actuated with electric trim tab in port aileron, rudder and each elevator; 'scaled-down ATR' single-slotted Fowler flaps, also electrically actuated, along 71 per cent of each wing trailing-edge; slotted spoiler forward of each flap at outer end, linked mechanically to aileron; yaw damper.

STRUCTURE: Mainly of light alloy and steel except for control surfaces, flaps, most of tailplane and fin of Nomex honeycomb bonded to metal sheet; wing leading-edges and landing gear doors GFRP/CFRP; tailcone and wingtips GFRP; two-spar torsion box forms integral fuel tank in each wing.

LANDING GEAR: Hydraulically retractable tricycle type, with emergency manual operation. Inward-retracting main units of trailing-link type; rearward-retracting steerable nosewheel (±28°). Main tyres 18x5.5 (8 ply; 10 ply on 700C2) tubeless; nose 5.00-5 (10 ply) tubeless. Parker hydraulic disc brakes. Minimum ground turning radius (based on nosewheel) 23.98 m (78 ft 8 in).

POWER PLANT: One 1,361 kW (1,825 shp) Pratt & Whitney Canada PT6A-66D turboprop, flat rated at 634 kW (850 shp), although certification limits T-O power to 522 kW (700 shp). Hartzell HC-E4N-3/E9083S(K) four-blade constant-speed, fully feathering, reversible-pitch, metal propeller. Fuel in integral tank in each wing, combined capacity 1,100 litres (290.5 US gallons; 242 Imp gallons), of which 1,066 litres (282 US gallons; 234 Imp gallons) usable. Gravity filling point in top of each tank. Oil capacity 12 litres (3.2 US gallons; 2.6 Imp gallons).

ACCOMMODATION: Adjustable seats for one or two pilots at front. Dual controls standard. Four seats in club layout aft of these, with centre aisle, or five seats in high-density layout. Optional 24 V power points (two). Accommodation pressurised, heated and ventilated; air conditioning optional.

Large upward-opening door on port side aft of wing; overwing emergency exit on starboard side. Oxygen system, comprising three under-seat bottles with individual emergency oxygen mask for each passenger and masks with integral microphones for crew. Pressurised baggage compartment at rear of cabin, with internal access only; additional unpressurised compartments in nose, between engine and firewall, and behind cabin, both with external access via doors on port side. From TBM 700C version onwards, nose compartment reduced in size by two-thirds, compared with 700B, due to installation of environmental control system. Optional crew door, port side, front, is maker's OPT 70-52-002.

SYSTEMS: Bendix/King KFC 325 autopilot with altitude preselect. Engine bleed air pressurisation (to 0.43 bar; 6.2 lb/sq in) and Honeywell environmental control system/vapour control system. Hydraulic system for landing gear only. Electrical system powered by one 28 V 180 A (main) and one 28V 57 Ah engine-driven starter/generator, and a 28 V 43 Ah lead/acid (optionally Ni/Cd) battery. Pneumatic rubber-boot de-icing of wing/tailplane/fin leading-edges. Propeller blades, pitot tubes and stall warning sensor; anti-iced, electrically heated engine inlet. Electric anti-icing and hot air demisting of windscreens. Gaseous oxygen system.

AVIONICS: *Comms:* Dual Garmin GNS 530 VHF com/VOR/ILS/GPS with GI 106A VOR/ILS indicator; dual GTX 327 Mode C transponders; GMA 340 stereo audio panel with marker beacon and music input; tri-band ELT; dual Bose X headsets with noise attenuation, all standard.

Radar: Honeywell RDR-2000 weather radar optional.

Flight: Bendix/King KCS 55 A heading and KI 525 A HSI indicators; KR 87 SC+ ADF; KRA 405 B radar altimeter with KNI 415 indicator; KN 63 DME with twin KI 574 indicators all standard. WX 500 Stormscope; and KMH 880 TCAS and TAWS, all optional.

Instrumentation: Bendix/King EFIS 40 two-tube EFIS; KMD 850 MFD; electric artificial horizon; standby vacuum artificial horizon; ASI; VSI; KEA 346 encoding drum altimeter; KNI 582 RMI indicator; KDI 574 DME indicator; rate of climb indicator; magnetic compass; torque indicator; propeller tachometer; ITT indicator; OAT gauge; electric generator control and monitoring on overhead panel; annunciator panel with master caution, master warning and aural warnings; cabin temperature gauge; cabin altitude and differential pressure indicator; flight time hours meter; and digital chronometer, all standard. Thommen needle chronometer (replaces digital chronometer), and engine hours meter (replaces flight time hours meter), optional.

DIMENSIONS, EXTERNAL:

Wing span	12.68 m (41 ft 7 1/4 in)
Wing chord, mean aerodynamic	1.51 m (4 ft 11 1/2 in)
Wing aspect ratio	8.9
Length overall	10.645 m (34 ft 11 in)
Height overall	4.355 m (14 ft 3 3/4 in)
Tailplane span	4.99 m (16 ft 4 1/2 in)
Wheel track	3.87 m (12 ft 8 1/4 in)
Wheelbase	2.91 m (9 ft 6 1/2 in)
Propeller diameter	2.31 m (7 ft 7 in)
Crew door (optional): Height	1.02 m (3 ft 4 in)
Width	0.78 m (2 ft 6 1/2 in)
Cabin door: Height	1.19 m (3 ft 10 3/4 in)
Width	1.08 m (3 ft 6 1/2 in)
Rear baggage door: Height	0.39 m (1 ft 3 3/4 in)
Width	0.25 m (9 3/4 in)

DIMENSIONS, INTERNAL:

Cabin: Length	4.05 m (13 ft 3 1/2 in)
Max width	1.21 m (3 ft 11 3/4 in)
Max height	1.22 m (4 ft 0 in)
Cargo floor area	3.15 m ² (33.91 sq ft)
Volume	3.5 m ³ (124 cu ft)
Baggage compartment volume: front	0.08 m ³ (2.8 cu ft)
rear	0.10 m ³ (3.5 cu ft)

AREAS:

Wings, gross	18.00 m ² (193.75 sq ft)
Vertical tail surfaces (total)	2.56 m ² (27.55 sq ft)
Horizontal tail surfaces (total)	4.76 m ² (51.24 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, basic	2,132 kg (4,700 lb)
Max baggage weight (all areas)	135 kg (298 lb)
Payload: max	605 kg (1,333 lb)
with max fuel	385 kg (849 lb)
Max fuel weight (usable)	866 kg (1,910 lb)
Max T-O weight	3,354 kg (7,394 lb)
Max ramp weight	3,370 kg (7,430 lb)
Max zero-fuel weight	2,736 kg (6,032 lb)
Max landing weight	3,186 kg (7,024 lb)
Max wing loading	186.3 kg/m ² (38.16 lb/sq ft)
Max power loading: T-O	5.72 kg/kW (9.48 lb/shp)
cruise	less than 5.29 kg/kW (8.70 lb/shp)

PERFORMANCE:

Max cruising speed at FL260	320 kt (593 km/h; 368 mph)
Econ cruising speed at FL310	252 kt (467 km/h; 290 mph)
Stalling speed: clean	82 kt (152 km/h; 95 mph) IAS
flaps and landing gear down	65 kt (121 km/h; 75 mph) IAS

For details of the latest updates to *Jane's All the World's Aircraft* online and to discover the additional information available exclusively to online subscribers please visit jawa.janes.com

Max rate of climb at S/L	725 m (2,380 ft)/min
Time to FL260	15 min
Time to FL310	20 min
Max certified altitude	9,450 m (31,000 ft)
T-O to 15 m (50 ft)	866 m (2,845 ft)
Landing from 15 m (50 ft)	741 m (2,435 ft)

Range, NBAA IFR reserves:	
with max payload: econ cruise	1,100 n miles (2,037 km; 1,265 miles)
max cruise	1,005 n miles (1,861 km; 1,156 miles)
with max fuel: econ cruise	1,520 n miles (2,815 km; 1,749 miles)
max cruise	1,365 n miles (2,528 km; 1,570 miles)
g limits	+3.8/-1.5

VOLIRIS

VOLIRIS SARL

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e-mail: info@voliris.com
Web: www.voliris.com
PRESIDENT: Simon Theuveny

HEADQUARTERS: Centre d’Affaires de Moulins, Aérodrome Moulins-Montbeugny, F-03400 Toulon sur Allier

Voliris was formed in February 1999 and has since produced a number of small remotely controlled airships. A prototype of its first piloted product, the Voliris 900, flew on 26 June 2003, followed by a second airship in 2005.

VOLIRIS 900

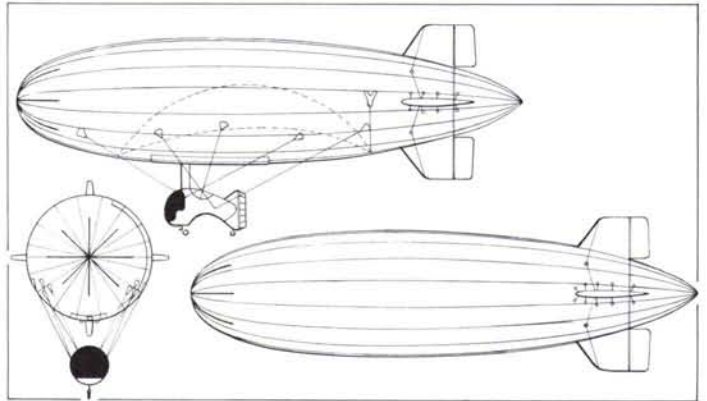
TYPE: Helium non-rigid airship.
PROGRAMME: Development process included 9.5 m (31.2 ft) long, 25 m³ (883 cu ft) radio-controlled model. Assembly of full-scale prototype completed in June 2002 and engine fitted early in following month. First helium inflation 21 June 2002; revealed publicly 26 June 2002 at Meudon. First flight at Clermont-Ferrand air base on 26 June 2003, registered (F-)WAAN. Re-registered in ultralight series as 03-VS by early 2005; promotional tour of Gabon in November 2005.
DESIGN FEATURES: Envelope is modified version of RosAeroSystems Au-12 (which see); first, for prototype, was delivered in May 2002. Gondola is French-built.
POWER PLANT: One 74.6 kW (100 hp) four-cylinder two-stroke engine, with fuel injection, driving pusher propeller at rear of gondola. One patented 18.6 kW (25 hp) two-cylinder four-stroke engine, driving an auxiliary propeller in duct in centre of gondola, provides additional upward and downward movement control for ground manoeuvring.



Voliris 900 helium non-rigid airship 1128936



Gondola of Voliris 900 prototype 1128937



Voliris 900 with production-style gondola (James Goulding) 1159080

ACCOMMODATION: Pilot and one passenger.	
DIMENSIONS, EXTERNAL:	
Length overall	31.00 m (101 ft 8½ in)
Envelope max diameter	8.00 m (26 ft 3 in)
DIMENSIONS, INTERNAL:	
Envelope volume	996 m ³ (35,175 cu ft)
Helium volume	900 m ³ (31,783 cu ft)
AREAS:	
Envelope surface area	615.0 m ² (6,620 sq ft)
PERFORMANCE:	
Max level speed	45 kt (85 km/h; 52 mph)
Cruising speed	40 kt (75 km/h; 47 mph)
Max operating altitude	1,500 m (4,920 ft)
Endurance	5 h

YAK AERO

YAK AERO SARL

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In 2006, Yak Aero launched a version of the Lucas L 11 at the RSA Rally at Blois.

YAK AERO BENELOS

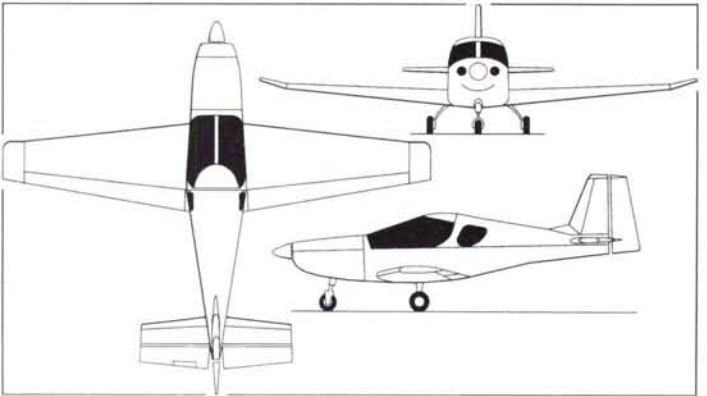
TYPE: Side-by-side ultralight.
PROGRAMME: Emile Lucas (emile.lucas.9@online.fr) designed L 11 (prototype W33PM) for amateur assembly from plans (EUR400 per set); recommended power plant is 59.7 kW (80 hp) Jabiru 2200; intended L 12 offers simpler manufacture through employment of constant-chord wings.
Factory-built version offered by Yak Aero from 2006 as Benelos.
DESIGN FEATURES: Low-mounted, rhomboidal wing and tailplane; increased dihedral at wingtips. Sweptback, rhomboidal fin. Lower fuselage swept upwards aft of cockpit.



Lucas L 11, basis of Yak Aero Benelos 1158660

FLYING CONTROLS: Conventional and manual. Four-position flaps. Tailplane trim tab.
STRUCTURE: Generally of riveted 2024 aluminium.
LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, spring cantilever mainwheel legs; trailing link nosewheel. Hydraulic mainwheel brakes.
POWER PLANT: One 59.7 kW (80 hp) Yamaha YE80 Diesel-fuelled motorscooter engine driving a two-blade propeller. Fuel in wingroot tanks, combined capacity 80 litres (21.1 US gallons; 17.6 Imp gallons).
EQUIPMENT: Optional ballistic recovery parachute.
DIMENSIONS, EXTERNAL:

Wing span	7.80 m (25 ft 7 in)
Length overall	5.60 m (18 ft 4½ in)
AREAS:	
Wings, gross	9.15 m ² (98.5 sq ft)



Yak Aero Benelos (Paul Jackson) 1159582

WEIGHTS AND LOADINGS:

Weight empty	282 kg (622 lb)
Max T-O weight	498 kg (1,097 lb)

PERFORMANCE:

Normal cruising speed	100 kt (185 km/h; 115 mph)
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Stalling speed	36 kt (65 km/h; 41 mph)
Max rate of climb at S/L	312 m (1,023 ft)/min
Endurance	6 h 30 min
g limits	+6/-3

Georgia

TBILAVIAMSHENI

TBILAVIAMSHENI JSC
(TBILISI AEROSPACE MANUFACTURING JSC)

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Web: www.tam.ge
CHAIRMAN: Pantiko Tordia
DIRECTOR GENERAL: Nodar Beridze
FIRST DEPUTY GENERAL DIRECTOR AND CHIEF ENGINEER: Gocha Goguadze

Former Tbilisi Aviation State Association (TASA) became Tbilisi Aerospace Manufacturing (TAM) upon privatisation in 2000, adopting present name when incorporated as a joint stock company in 2002. TASA was established 15 December 1941 when No. 448 Engine Manufacturing plant was augmented by the evacuated No. 31 Aircraft Factory from Taganrog and No. 45 Aircraft Repair Plant from Sevastopol; began aircraft production with the LaGG-3 fighter, and progressed through La-5, Yak-3, Yak-15, Yak-17/17UTI, Yak-23, MiG-15 and MiG-17 to building 1,677 MiG-21U/UMs (for which it offers an upgrade programme) between 1957 and 1984. The plant also began Su-25/25U production in 1978 and has produced 875 basic single-seat versions, including 50 Su-25BM target-tugs. In total, it has built over 8,070 manned aircraft, 2,555 UAVs and over 36,000 AAMs (30,000 R-60/AA-8s and 6,000 R-73/AA-11s). Continues to support Kela ultralight, first built in 1970s. Offers upgrades and overhauls for Mil helicopters.

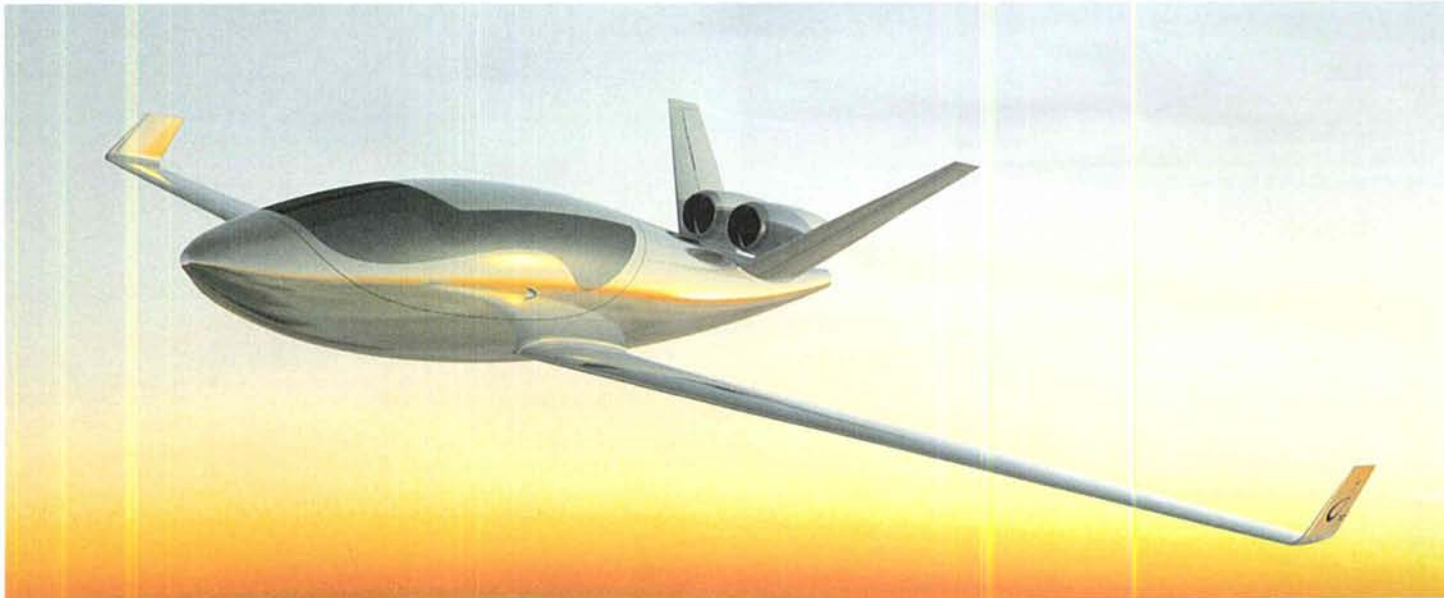
Current manufacture, at low rate, is of the Su-25UB two-seat trainer; also produced small batch of its Su-25T (Su-39) derivative. Production is also stated to be under way of a batch of 20 Yak-58 light transports, although there is no evidence of recent sales. Upgrade activities include a 'Frogfoot' modernisation, the Su-25KM Scorpion, a prototype of which flew in 2001.

The 250,000 m² (2,691,000 sq ft) TAM plant employed 15,000 personnel at its peak, but currently has a workforce of about 2,300. A 1999 alliance with Kelowna Flightcraft of Canada provides for TAM to assist with production of materials for the Convair 5800 conversion programme and eventually undertake the entire programme, if demand warrants. TAM additionally plans to fabricate components for the US-designed ViperJet two-seat kitbuilt.

Also reported in late 2003 to have built two Leader light business jets, following agreement, with Maverick, also of US. However, TAM terminated the Maverick agreement in January 2004, 10 months after it had begun, and before the first aircraft could be flown. Unofficial report of November 2005 claimed Maverick, also known as TAMjet, made first flight earlier in 2005, while in late 2005 company was continuing to promote TAMjet.

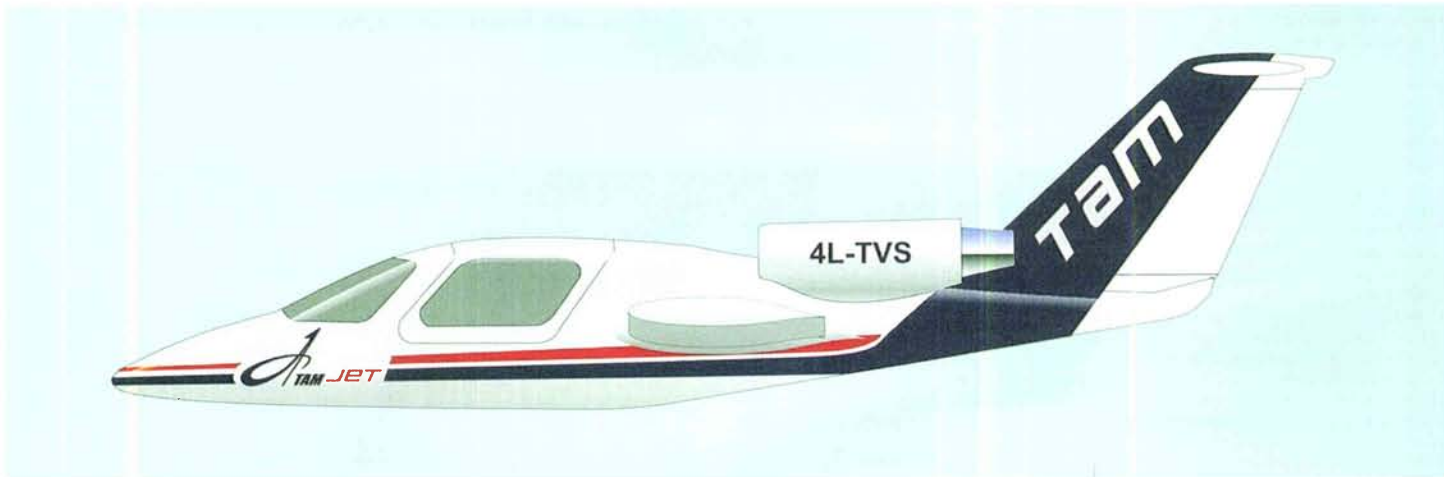
By August 2004 had been appointed by Aircraft Investor Resources of USA to build fuselage, wing and empennage for Epic LT turboprop and also is investing partner in AIR Epic Jet, to be marketed initially in US Experimental (home-assembled) category. Epic Jet will be assembled by Tbilaviamsheni for European, Middle East and Asian markets under the name, **Elite**. A follow-on design for a business jet, named **Alien**, is under design, with styling by fellow Tbilisi company, Tsikolia Design.

Non-aviation products include ground power units, domestic space heaters, combined harvesters and roofing materials.



Artist's impression of TAM Alien business jet

1154290



TAMjet profile from late-2005 literature

1154291

Germany

328 SUPPORT SERVICES

328 SUPPORT SERVICES GMBH

Corporate Jet Services, Hangar 2, Southampton Airport, Hampshire SO18 2HG, United Kingdom
WORKS:
Flugplatz Oberpfaffenhofen, PO Box 1103, D-88230 Wessling
MANAGING DIRECTOR: Wolfgang Walter

Bankrupt AvCraft Aerospace GmbH was purchased on 15 December 2005 by Corporate Jet Services, the parent company of executive charter operator Club 328. AvCraft was formally taken over on 2 January 2006 and renamed 328 Support Services. The acquisition covers engineering, maintenance and refurbishment, product support, the spare parts business and the type certificate for the Dornier 328 and 328JET.

The new company planned only to complete the last three Dornier 328s on the assembly line before devoting itself wholly to maintenance and support of the 220 or so remaining examples of the aircraft, including its turboprop predecessor, with the assistance of two-thirds of the original workforce of 140. Following a change of plan, only one aircraft was completed before manufacture was terminated.

DORNIER 328JET

TYPE: Regional jet airliner.

PROGRAMME: Development of Dornier 328 turboprop twin begun in mid-1980s, but then suspended; relaunched 3 August 1988; rolled out 13 October 1991; first flight (D-CHIC) 6 December 1991; first flight of first production 328-100 (D-CITI) 23 January 1993. JAA 25 certification 15 October 1993; FAA certification 10 November 1993; first delivery, to Air Engiadina, 21 October 1993. Production (including three prototypes) totalled 111; final aircraft (OE-LKC) delivered to Air Alps Aviation, Austria, 13 October 1999.

Twin turbofan version announced 5 February 1997 and formally launched at Paris Air



Last Dornier 328JET built by 328 Support Services, March 2006

1040387

Show in June 1997; marketed as 328JET, engineering designation being 328-300; known as 328Jet from 2003. High-speed wind tunnel tests, confirming cruise performance, and ground vibration tests completed by November 1997; prototype D-BJET, converted from second prototype 328 turboprop (D-CATI), rolled out 6 December 1997; first flight 20 January 1998; public debut 4 February 1998; three further prototypes built on the production line; second (D-BWAL) dedicated to performance certification testing, flew 20 May 1998; third (D-BEJR), used for avionics certification, flew 10 July 1998; fourth (D-BALL), used for function and reliability testing and simulated airline operation trials, flew on 15 October 1998; JAA certification was achieved on 8 July 1999 after completion of 1,560 flight hours in 950 sorties; FAA certification 15 July 1999; high gross weight certification achieved April 2000.

First delivery in July 1999 to Skyway Airlines (N351SK); total of 15 delivered in 1999 and 33 in 2000. By June 2001 the in-service fleet of aircraft had logged 100,000 hours, with a 99.23 per cent flight completion rate; high-time aircraft, operated by Hainan Airlines, had then logged nearly 4,000 hours. Production suspended by late 2002, following Fairchild Dornier's bankruptcy.

Programme purchased by AvCraft in January 2003; assets included 18 'white tail' aircraft in complete condition and five on production line; deliveries began on 11 September 2003 with B-3948 to Hainan Airlines; production relaunched in December 2003 16 'whitetails' sold by late January 2004. First new production aircraft (D-BADA, c/n 3224) delivered in March 2005, but Avcraft filed for bankruptcy in same month and final four incomplete aircraft transferred to 328 Support Services in January 2006. One immediately completed for Club 328; this was D-BDXC, c/n 3220, delivered to Iceland 21 March 2006, becoming TF-NPA with Nordic Wings (leased to City Star). Completion of c/ns 3221, '22 and '23 was then abandoned.

CURRENT VERSIONS: **328Jet**: Regional airliner, *as described*; 32 passengers at 79 cm (31 in) seat pitch. Engineering designations **328-300** and **328-310**.

328Jet SMA: Proposed multirole special missions aircraft for troop transport, VIP missions, surveillance, SAR, AEW and medevac. Under study in 2002.

Freighter: All-cargo version with large door in aft fuselage for loading of containers or palletised freight. No longer being promoted.

Envoy: Business jet and corporate shuttle version, launched at the 1997 National Business Aviation Association Convention in Dallas, Texas; known as Envoy 3 until 2003. Subvariants are Envoy **Executive** with accommodation for 12 passengers and forward service galley and wardrobe and aft galley and lavatory; Envoy **Executive Shuttle** accommodating 22 to 32 passengers; and Envoy **Convertible** for 14 and 18 passengers and with forward galley. Executive standard fuel weight 5,042 kg (11,116 lb); Shuttle and **Convertible** have standard 328Jet capacity, with option of extra tanks.

Total of 10 Envoy orders by December 2001. Announced customers include Aircraft Jetcharter, which has ordered a Corporate Shuttle variant for operation on behalf of an Ohio-based customer, and Grupo Protexa of Monterey, Mexico, which has ordered one aircraft in executive configuration. Aircraft Completions of Tyler, Texas, is US completions centre.

Dornier 428: Developed version; programme suspended on 8 August 2002.

AEROSTYLE

AEROSTYLE ULTRALEICHT FLUGZEUGE GMBH

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DIRECTOR: Ralf Magnussen

The company's first product, the Breezer, is in production as a kit and is being marketed by Ikarus in complete form. LSA version sales by Sportsplanes.com of US. The aircraft are built in Kamenz.

AEROSTYLE BREEZER

TYPE: Side-by-side ultralight/kitbuilt; two-seat lightplane.

PROGRAMME: Designed by Ralf Magnussen. Prototype (D-MOOV) exhibited unflown at Aero'99 at Friedrichshafen in April 1999; first flight was made in December 1999. Noise tests under way in mid-2000; German certification was achieved in second quarter of 2001. Prototype was exhibited at Friedrichshafen in April 2001 with modifications including steerable nosewheel replacing original trailing-link type. In 2002 an Experimental version with empty weight of 320 kg (705 lb) and max T-O weight of 580 kg (1,278 lb) was being offered. UK and US marketing began in 2005 after LSA approval achieved that year. Short-wing version introduced in 2006 with 8.03 m (26 ft 4¼ in) span; gives weight saving of 4 kg (9 lb).

CURRENT VERSIONS: **Aerostyle Breezer**: European Ultralight, MTOW 472.5 kg (1,041 lb).

Aerosport Breezer: Factory-built LSA for US market, MTOW 598 kg (1,320 lb). Distributed by Aerosport of Draper, Utah.

CUSTOMERS: A combined total of 76 kits and complete aircraft sold by Aerostyle up to December 2005. Production of complete aircraft now undertaken by Grizl of Kamenz with marketing by Ikarus at Höhentengen.

COSTS: EUR23,700 excluding taxes (2005). Complete Ikarus Breezer EUR55,300 (2005).

DESIGN FEATURES: Low, constant-chord wing, with wingtips upturned at rear. Sweptback fin. Wing aerofoil section NACA 4414. Quoted build time 600-800 hours.

FLYING CONTROLS: Conventional and manual. Horn-balanced elevators and rudder; plain ailerons; trim tab in port elevator; mechanical (electric optional) half-span Fowler flaps with external mass balance.

STRUCTURE: Mainly riveted aluminium, with glass fibre for some non-structural fairings, such as wingtips, cowling and rear fuselage.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, spring composites cantilever mainwheel legs with wheel fairings; composites steerable nose leg; with wheel fairings. Hydraulic brakes on mainwheels. Mainwheel size 14x4, nosewheel 4.00x4.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS engine driving a three-blade ground-adjustable Neuform T3 propeller; other optional engines include the 59.7 kW (80 hp) Jabiru 2200 and 89.4 kW (120 hp) Jabiru 3300. Optionally a 59.6 kW (79.9 hp) Rotax 912 UL can be fitted. Fuel capacity 70 litres (18.5 US gallons; 15.4 Imp gallons).

SYSTEMS: 12V battery.

EQUIPMENT: Optional Junkers or BRS-5-UL ballistic parachute.

DIMENSIONS, EXTERNAL:

Wing span 8.71 m (28 ft 7 in)
Length overall 6.36 m (20 ft 10½ in)
Height overall 2.12 m (6 ft 11½ in)

DIMENSIONS, INTERNAL:

Cockpit max width 1.17 m (3 ft 10 in)

AREAS:

Wings, gross 11.85 m² (127.6 sq ft)

WEIGHTS AND LOADINGS (estimated):

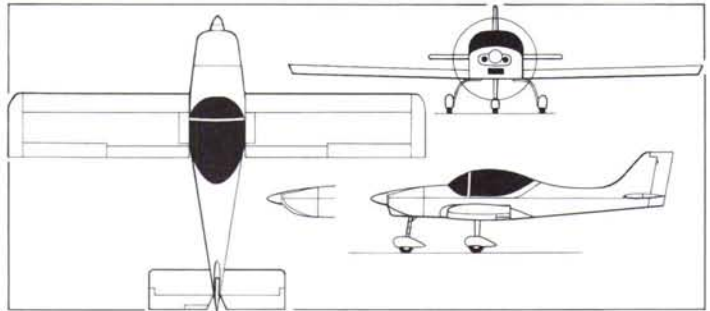
Weight empty 285–295 kg (628–650 lb)

Max T-O weight 600 kg (1,322 lb)

PERFORMANCE (estimated, A: 67.1 kW/90 hp engine; B: 73.5 kW/98.6 hp engine):

Max level speed: A 116 kt (215 km/h; 134 mph)

B 121 kt (225 km/h; 140 mph)



Aerostyle Breezer all-metal two-seat ultralight aircraft, with scrap view of Rotax engine nose (James Goulding)

1121719



US demonstrator of Aerostyle Breezer being promoted for Light Sport category

1159273

Cruising speed: A	105 kt (195 km/h; 121 mph)
B	108 kt (200 km/h; 124 mph)
Stalling speed: A, B	36 kt (65 km/h; 41 mph)
Max rate of climb at S/L: A	270 m (886 ft)/min
B	360 m (1,181 ft)/min

T-O run: A	135 m (395 ft)
B	95 m (312 ft)
Landing run: A, B	140 m (460 ft)
Range	459 n miles (850 km; 528 miles)
g limits	+4/-2

AQUILA

AQUILA TECHNISCHE ENTWICKLUNGEN GMBH

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DIRECTORS:
Peter Grundhoff
Alfred Schmiderer
Markus Wagner
MARKETING MANAGER: Siegfried Dörfler

Company formed August 1996 to develop A 210; employed 12 staff at Schönhagen aerodrome by April 2000; increased to 20 during 2001 and reached 38 by December 2003, and 43 by May 2004; following mid-2000 commissioning of new production hangar; capacity 50 aircraft per year. Distributors for France, the Netherlands, Scandinavia and Switzerland have been appointed. On 19 January 2005, Aquila filed for bankruptcy; administrator permitted resumption of production on 1 March 2005 and deliveries resumed immediately.

AQUILA A 210

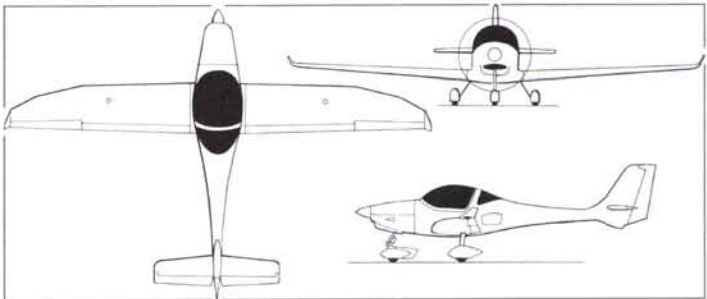
Engineering designation: AT 01

TYPE: Two-seat lightplane.
PROGRAMME: Launched 1995; design, using CAD/CAM techniques, began 1997, assisted by Berlin Technical University; prototype (D-EQUI) displayed at Aero'99, Friedrichshafen, in April 1999; first flight 5 March 2000; initially flew without winglets; certification, as AT 01, to JAR-VLA received September 2001; deliveries began July 2002 with first aircraft (D-ETHG) to Flugschule Hans Grade at Schönhagen. Certification in USA awarded 4 November 2003; Australia, France and Switzerland also completed during 2003; certification in Austria, Scandinavia and the UK was expected during 2004.
CUSTOMERS: Total 51 firm orders by May 2004, including pilot trainers for Lufthansa, and club aircraft for EADS Aéroports de Paris and airline Swiss. Total 28 (including prototype) completed by end of 2004, when bankruptcy temporarily intervened. On resumption of manufacture on 1 March 2005, Aquila had order backlog extending into 2006 at rate of two



Aquila A 210 used for pilot training at Graz, Austria (Paul Jackson)

1158288



Aquila A 210 all-composites light aircraft (Rotax 912 ULS flat-four)
(James Goulding)

0137230

aircraft per month. Total of 50 (including prototype) completed by June 2006 for customers in Austria, Belgium, France, Germany, Russian Federation and Switzerland.
COSTS: EUR121,000 excluding tax (2005).
DESIGN FEATURES: Design goals included crashworthy cabin structure, forgiving handling characteristics and low operating costs. Low wing with sharply tapered fuselage aft of cabin and sweptback fin; high aspect ratio wing with upturned tips.
Laminar flow wing section Horstmann/Quast HQ-42 modified. Dihedral 4° 30'.
FLYING CONTROLS: Conventional and manual. Actuation via pushrods for elevators and ailerons; cables for rudder. Integral fixed-angle rudder tab and balanced ailerons. Externally hinged, single-slotted Fowler flaps, deflections 15 and 35°.
STRUCTURE: Entirely CFRP/GFRP. Fuselage is a GFRP monocoque with CFRP stringers and GFRP/CFRP frames; wing shell structure and tail unit and control surfaces are GFRP/polyurethane foam sandwich with CFRP wingspar, load-bearing structures and local reinforcements.
LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring steel mainwheel legs; steerable nose leg with rubber-in-compression suspension; all wheels size 5.00-5; speed fairings on all wheels; hydraulic brakes; combined ventral fillet/tailskid.
POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912S flat-four engine driving an MT-Propeller MTV-21-A/175-05 two-blade, variable-pitch (hydraulic) propeller. Fuel in two integral wing tanks, total capacity 120 litres (31.7 US gallons; 26.4 Imp gallons). Fuel filler in upper surface of each wing.
ACCOMMODATION: Two persons side by side under forward- and upward-opening windscreen/canopy; baggage door on port side of aft wing. Four-point safety harnesses for both occupants. Accommodation heated and ventilated. Choice of leather or cloth seating. SYSTEMS: 14 V electrical system, including 40 Ah alternator and 12 V 19 Ah battery. Heavy duty 29 Ah battery optional.
AVIONICS: Comms: Bendix/King KX 125 com/nav; KT 76A transponder; encoding altimeter. PS Engineering PM 501 intercom, and ELT, all standard. Becker AR 4201 second com. Bendix/King KT 76C Mode C digital transponder with encoder, Bendix/King KT 73 Mode S datalink transponder. Garmin GTX 327 transponder, KMA 28 audio panel, GMA 340 audio panel, and 406 MHz ELT, all optional.
Flight: Bendix/King KX 155 com/nav with GI 106A VOR/LOC/GS indicator and KMD 150 GPS with colour MFD, Garmin GNS 430 com/nav/GPS with GI 106A VOR/LOC/GS indicator, optional.

Instrumentation: Three-point altimeter, ASI, VSI, magnetic compass, artificial horizon, directional gyro, turn co-ordinator, CHT gauge, oil temperature/pressure gauges, fuel gauge, tachometer, manifold pressure gauge, OAT gauge, Hobbs hour meter, Davtron M800 chronometer, all standard.

EQUIPMENT: Navigation, anti-collision and landing lights and tiedown fittings, standard. Optional equipment includes auxiliary/external power receptacles, tinted canopy, fire extinguisher and aero-tow system.

DIMENSIONS, EXTERNAL:

Wing span, excl winglets	10.30 m (33 ft 9½ in)
Wing aspect ratio	10.1
Length overall	7.30 m (23 ft 11½ in)
Height overall	2.30 m (7 ft 5½ in)
Fuselage max width	1.20 m (3 ft 11¼ in)
Tailplane span	3.00 m (9 ft 10 in)
Wheel track	1.94 m (6 ft 4½ in)
Wheelbase	1.66 m (5 ft 5½ in)
Propeller diameter	1.75 m (5 ft 9 in)
Baggage door: Max width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin max width	1.20 m (3 ft 11¼ in)
Baggage volume	0.50 m ³ (17.66 cu ft)

AREAS:

Wings, gross	10.50 m ² (113.0 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	490 kg (1,080 lb)
Baggage capacity	40 kg (97 lb)
Max T-O weight	750 kg (1,653 lb)
Max wing loading	71.4 kg/m ² (14.63 lb/sq ft)
Max power loading	10.20 kg/kW (16.76 lb/hp)

PERFORMANCE:

Max level speed	165 kt (306 km/h; 190 mph)
Max cruising speed	130 kt (241 km/h; 150 mph)
Cruising speed: at 75% power at FL50	121 kt (224 km/h; 139 mph)
at 55% power at FL50	103 kt (191 km/h; 119 mph)
Stalling speed: flaps up	50 kt (93 km/h; 58 mph)
flaps down	43 kt (80 km/h; 50 mph)
Max rate of climb at S/L	229 m (750 ft)/min
Service ceiling	4,420 m (14,500 ft)
T-O run	250 m (820 ft)
T-O to 15 m (50 ft)	470 m (1,542 ft)
Landing from 15 m (50 ft)	500 m (1,640 ft)
Landing run	200 m (656 ft)
Range with max fuel at 75% at FL50	535 n miles (990 km; 615 miles)
55% power at FL50, 45 min reserves	620 n miles (1,148 km; 713 miles)
Max endurance	6 h 5 min

AUTOGYRO EUROPE

AUTOGYRO EUROPE GMBH

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DIRECTORS: Thomas Kiggen

Michael Ullrich

AutoGyro Europe was formed to market the MT-03 autogyro, previously developed by the founders under the business name of UL-Flugschule Höxter. Sales accelerated during 2005; dealerships established in UK, South Africa and elsewhere.

AUTOGYRO EUROPE MT-03

TYPE: Two-seat autogyro ultralight.

PROGRAMME: Developed from an earlier Spanish design; first autogyro to gain modern German certification. Gained UK BCAR Section T certification in 2006.

CUSTOMERS: Sales of 45 by June 2006.

COSTS: EUR42,800 to EUR51,000, depending on specification, plus taxes (2006).

DESIGN FEATURES: Open, tandem seating, pod-and-boom configuration with sweptback central fin, plus stabilising fins at tailplane ends; rudder on central fin only. Prerotation by metal tube drive with universal joints.

Rotor design by Air Copter of France; aerofoil section NACA 8H12.

STRUCTURE: Welded, rectangular, stainless steel tube chassis and composites pod and empennage of carbon fibre and glass fibre. Aluminium rotor.

LANDING GEAR: Tricycle type, fixed. Cantilever composites spring mainwheel legs with speed fairings and hydraulic brakes. All tyres 4.80/4.00-8.

POWER PLANT: One Rotax flat-four: 73.5 kW (98.6 hp) 912 ULS or 84.5 kW (113.3 hp) turbocharged 914 UL. Three-blade, carbon fibre, fixed-pitch propeller. Fuel tank beneath rear seat, capacity 32 litres (8.5 US gallons; 7.0 Imp gallons) normal; 69 litres (18.2 US gallons; 15.2 Imp gallons) optional.

DIMENSIONS, EXTERNAL:

Rotor diameter	8.40 m (27 ft 6¾ in)
Length overall	5.10 m (16 ft 8¾ in)



AutoGyro Europe MT-03 used for UK trials (Paul Jackson)

1159343

Height overall	2.60 m (8 ft 6¼ in)
Width overall	1.80 m (5 ft 10¾ in)

WEIGHTS AND LOADINGS:

Weight empty	239 kg (527 lb)
Max T-O weight	450 kg (992 lb)

PERFORMANCE (Rotax 914 engine):

Never-exceed speed (VNE)	88 kt (163 km/h; 101 mph)
Cruising speed	70 kt (130 km/h; 81 mph)
Max rate of climb at S/L	300 m (984 ft)/min
T-O run	up to 70 m (230 ft)
Landing run	up to 15 m (50 ft)
Max range	216 n miles (400 km; 248 miles)

B&F

B&F TECHNIK VERTRIEBS GMBH

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PRESIDENT: Peter Funk

The FK series, which began in 1959 with the Grief 1a sailplane, is designed by father and/or son, Dipl Ing Otto Funk and Peter Funk. Latest products are the nostalgic FK 12 and FK 14 Polaris composites ultralights and a Mk IV version of FK 9.

Work on B&F's new 900 m² (9,700 sq ft) factory on the same airfield began in January 2002.

In 2003, B&F employed six people at its headquarters plus a further 45 at its Krosno, Poland, factory.

B&F FK 9

TYPE: Side-by-side ultralight.

PROGRAMME: Earlier versions of B&F's FK 9 were built at Krosno, Poland, employing metal tube fuselages and composites wings, both fabric-covered. The Mark 3 all-composites version was announced in 1997; 85 per cent of airframe is manufactured in Poland, for completion in Germany. Launched at Friedrichshafen Air Show, April 1997; UK sales promotion from July 1998. Following trials in earlier FK 9 (D-MCFK), 60.3 kW (80.9 hp) Mercedes M160 three-cylinder turbocharged engine, developed from that of DaimlerChrysler Smart motorcar, offered as alternative power plant from 2000 in version designated **FK 9 Smart**; first aircraft delivered 5 May 2004. LSA approval achieved 3 December 2005 for marketing in US.

CURRENT VERSIONS: **FK 9 Mark 3**: Baseline composites version, now superseded by Mk IV.

FK 9 Mark 3B: Sold by Brazilian dealership as Alpha Bravo FK-9. Span 10.33 m (33 ft 10¾ in); wing area 12.22 m² (131.5 sq ft). At least one exported to Portugal.

FK 9 Club: Utility version; launched at Aero '03, Friedrichshafen, April 2003 in Mark 3 form; now available as Mark 4.

FK 9 Mark IV: Replacement for Mk 3; has wider (4 cm; 1½ in), longer (8 cm; 3¼ in) cabin and larger flaps and tailplane. Prototype (D-MBKA) first flown by October 2003. *Detail description applies to this version.*

FK 9 Mark IV SW: Short-wing (9.25 m; 30 ft 4¼ in) wing span, compared to baseline version has improved forward visibility.

FK 9 Mark IV Utility: Utility version for flight training and towing. Nosewheel or tailwheel.

CUSTOMERS: Over 300 FK 9s of all series built by July 2006; 300th aircraft delivered 19 June 2006.

COSTS: Kit EUR29,580; standard flyaway version EUR51,852, LSA version EUR55,100, both including tax (2006).

FLYING CONTROLS: Conventional and manual. Flaps.

STRUCTURE: Glass fibre fuselage with steel tube cockpit frame; wing of carbon fibre structure and leading-edge with skin (incl ailerons) of carbon fibre (Mk IV) or Ceconite fabric (Mk IV Utility). Aluminium flaps and tailplane. Optional 'fully carbon fibre' wing; optional wing folding.

LANDING GEAR: Fixed; tricycle type (TG = trigear) standard; tailwheel type ('Classic') optional for FK 9 Explorer. Fuselage-mounted spring cantilever mainwheel legs with wheel fairings. Trailing-link nosewheel with wheel fairing; steerable. Mainwheels 6.00-6. Optional Czech Air Works 1150 floats can be fitted.

POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL (standard), 73.5 kW (98.6 hp) Rotax 912 ULS or 60.3 kW (80.9 hp) Mercedes M160/1 driving a Junkers three-blade, ground-adjustable pitch, carbon fibre propeller. Normal fuel capacity 70 litres (18.5 US gallons; 15.4 Imp gallons), of which 65 litres (17.2 US gallons; 14.3 Imp gallons) are usable. Optional extra 18 litre (4.8 US gallon; 4.0 Imp gallon) tank can be installed.

EQUIPMENT: Optimal BRS 5 ballistic parachute.

C+C FLYING

C+C FLYING GMBH

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CHIEF DESIGNER: Dr Ernst Alban

In 2003, C+C was building a prototype of its latest design, the CC/03; the earlier CC/01 and CC/02 remain available. A further aircraft, the CC/04, is under development. Known details last appeared in the 2006-2007 *Jane's All the World's Aircraft*.

DEWALD

DEWALD MELOS 3000

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DIRECTOR: Alexander Dewald
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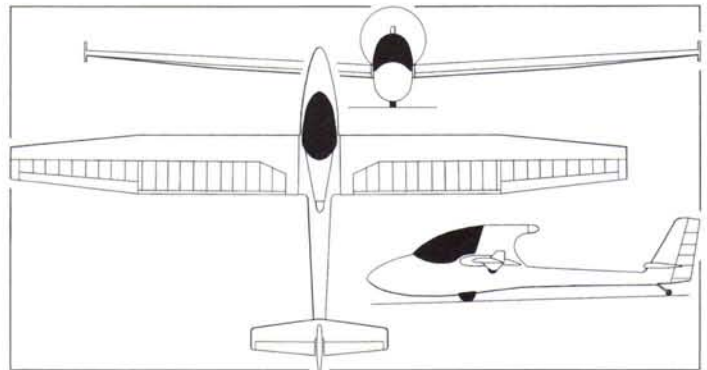
Dewald markets a wide range of light aircraft and accessories, including the Interplane Skyboy and Dewald Sunny series of single- and two-seat ultralights and the French series of Adventure paramotors. At Aero '05 in Friedrichshafen, the company launched the Melos 3000 motor glider. The Dewald Leonardo flying wing, tandem-seat motor glider and Springmaus (Hopping Mouse) ultralight single-seat remain under development.

DEWALD MELOS 3000

TYPE: Single-seat motor glider ultralight.
PROGRAMME: Melos DFB-1A, designed by Manfred Derschug, first flew in France (F-PMLS) in 2000, employing König engine; awarded 'most outstanding construction' at RSA meeting in 2002; renamed Melos 2000; exhibited at Friedrichshafen in April 2005 to represent Melos 3000 version to be produced in Germany from 2007.
CUSTOMERS: Three of original version built.
DESIGN FEATURES: Mid-mounted wing with tapered outer panels and winglets; folding, pusher propeller; cruciform empennage with sweptback fin. Can be dismantled for storage.
FLYING CONTROLS: Conventional and manual. Schempp-Hirth airbrakes.
STRUCTURE: Glass fibre fuselage with foam local reinforcement. Wooden wings with fabric covering to rear of leading-edge.
LANDING GEAR: Monowheel type; fixed. Auxiliary solid wheels at wingtips and tail.
POWER PLANT: Option of two piston engines, comprising 20.6 kW (27.6 hp) DSA 250 two-cylinder, four-stroke and similarly-rated Hirth F33 single-cylinder motors. Three-blade, carbon fibre, folding, pusher propeller. Fuel capacity 30 litres (7.9 US gallons; 6.6 Imp gallons).
EQUIPMENT: Ballistic parachute.
DIMENSIONS, EXTERNAL:
Wing span 11.00 m (36 ft 1 in)
Length overall 5.95 m (19 ft 6¼ in)
Height overall 1.50 m (4 ft 11 in)
AREAS:
Wings, gross 10.50 m² (113.0 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 195 kg (430 lb)
Max T-O weight 315 kg (694 lb)
PERFORMANCE, POWERED:
Normal cruising speed 78 kt (145 km/h; 90 mph)
Max rate of climb at S/L 180 m (591 ft)/min
Range 325 n miles (600 km; 372 miles)
g limits +6/-4



Melos 2000 prototype, generally representative of Melos 3000 (Paul Jackson) 1159345



Dewald Melos 3000 general arrangement 1159380

PERFORMANCE, UNPOWERED:
Stalling speed 35 kt (64 km/h; 40 mph)
Best glide ratio 25

EQUATOR

EQUATOR AIRCRAFT COMPANY

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PRESIDENT: Günter Pöschel

In early 2007, Equator was seeking orders and financial backing to launch production of an aircraft family suitable for utility and corporate transport duties. A modular approach gives the Equator four-, six-, eight-, 10- or 12-passenger capacity, with configurations ranging from low-price landplane with fixed gear and single piston engine single up to a pressurized, twin-turboprop amphibian. Key elements of the design include cabane-mounted engine(s) above the aircraft's centre of gravity; composites structure; and (as amphibian) 'float wing' design which eliminates wingtip floats by using the wing's lower surface as a stabilising spson.

Pöschel Aircraft GmbH became Equator Aircraft in 1974; made several appearances in *Jane's All the World's Aircraft* since late 1960s with P-300 and P-400 series aircraft, which mounted tractor propellers atop the fin. P-300 A1 landplane (D-EULM), with fixed landing



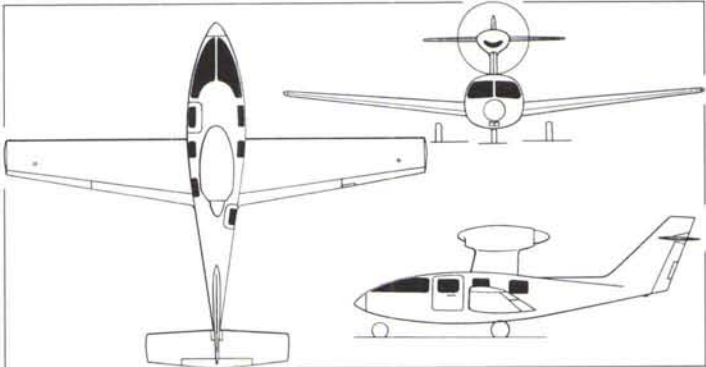
In-flight views of Equator P-300 A1 prototype and P-420 1158907



Manufactured image, based on P-300RG, of Equator amphibian in current configuration 1158908

gear, first flew 27 February 1971, powered by 216 kW (290 hp) Textron Lycoming IO-540; P-420 Turbo Equator amphibian, with 313 kW (420 shp) Allison (now Rolls-Royce) 250-B17C flew (D-EMGF) February 1977 but was lost on eighth flight due to engine failure on take-off.

At 1980 Hannover air show, mockup was shown of P-300RG, differing considerably from P-300A1, most notably in having cabane-mounted engine with pusher propeller; this was later marked D-EULM, which registration also appears on artist's impressions of proposed new variant.



General appearance of Equator series of amphibians (Dennis Punnett) 1158920

EVOLUTION

EVOLUTION SKYSERVICE

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Company makes a range of aerial advertising and inflatable media (balloons, radio-controlled unmanned blimps and tethered aerostats). It described its FS 200, revealed in 2003, as "the world's first true ultralight airship", but no evidence of completion or flight had emerged by mid-2006.

EXTRA

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CHIEF EXECUTIVE OFFICER: Kenneth L Keith
CHIEF DESIGNER: Walter Extra
GENERAL MANAGER: Extra GmbH: Corvin Huber
INFORMATION CONTACT: Bessy Donnelly

The former Extra Flugzeugbau GmbH, founded by Walter Extra, was forced to curtail activities in early 2003 as a consequence of insolvency. By mid-2003 the company had been restructured under US ownership as Extra Aircraft LLC. Research, development and manufacturing activities remain in Germany, with establishment of a US completions centre under consideration after 2004. Main production is of EA-300, although EA-200 in low rate manufacture.

EXTRA EA-200

Engineering designation: EA-300/200

TYPE: Aerobatic two-seat sportplane.

PROGRAMME: Prototype (D-ETEL) first flown 2 April 1996 and almost immediately shipped to USA for demonstrations and public debut at EAA Sun 'n' Fun in Lakeland, Florida, later that month; second prototype and principal flight test aircraft (D-EAZG) exhibited at ILA, Berlin, May 1996; German certification scheduled for 15 June 1996, followed by FAA certification (initially in Experimental/Exhibition Category) on 20 December 1996. May form the basis for future development of a new low-cost aerobatic aircraft.

CUSTOMERS: Prototype and five production aircraft delivered in 1996; 15 in 1997; five in 1998; further two in mid-1999; and one in mid-2000; further two completed in late 2001 for customers in USA and Ireland; none in 2002 or 2003; one each in 2004 and 2005; four in first half of 2006; total 37. Most exported to US. Total of six scheduled for manufacture in 2006.

COSTS: EUR175,000 (2006).

Data generally as for Extra EA-300, except that below:

FLYING CONTROLS: Control surface movements: ailerons $\pm 30^\circ$; elevators $\pm 22^\circ$; rudder $\pm 30^\circ$; trim tab $\pm 15^\circ$.

POWER PLANT: One 149 kW (200 hp) Textron Lycoming AEIO-360-A1E flat-four engine with Gomolzig exhaust, driving an MT-Propeller MTV-12-B-C/C183-17e three-blade, constant-speed propeller. Standard fuel capacity 122 litres (32.3 US gallons; 26.8 Imp gallons), of

which 117 litres (30.9 US gallons; 25.7 Imp gallons) are usable; optional long-range tanks increase usable capacity to 185 litres (48.9 US gallons; 40.7 Imp gallons). Aerobatic usable fuel limited to 36 litres (8.5 US gallons; 7.0 Imp gallons). Unusable fuel 5 litres (1.3 US gallons; 1.1 Imp gallons) in all cases.

DIMENSIONS, EXTERNAL:

Wing span 7.50 m (24 ft 7 1/4 in)
Wing aspect ratio 5.4
Length overall 6.50 m (22 ft 10 1/4 in)
Height overall 2.70 m (8 ft 4 3/4 in)
Propeller diameter 1.83 m (6 ft 0 in)

AREAS:

Wings, gross 10.40 m² (111.9 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped 562 kg (1,239 lb)
Max T-O weight: Aerobatic, solo 700 kg (1,543 lb)
Aerobatic, two-seat 800 kg (1,763 lb)
Normal 840 kg (1,851 lb)
Max wing loading:
Aerobatic, solo 67.31 kg/m² (13.78 lb/sq ft)
Aerobatic, two-seat 76.92 kg/m² (15.76 lb/sq ft)
Normal 80.77 kg/m² (16.54 lb/sq ft)

Max power loading:

Aerobatic, solo 4.69 kg/kW (7.71 lb/hp)
Aerobatic, two-seat 5.36 kg/kW (8.81 lb/hp)
Normal 5.63 kg/kW (9.25 lb/hp)

PERFORMANCE (N: at Normal category T-O weight, SA: at solo Aerobatic weight):

Never-exceed speed (VNE):
N 217 kt (402 km/h; 250 mph)
Manoeuvring speed 154 kt (285 km/h; 177 mph)
Cruising speed at 75% power:
N 150 kt (278 km/h; 173 mph)
Stalling speed: N 59 kt (110 km/h; 68 mph)
SA 53 kt (99 km/h; 61 mph)
Max rate of climb at S/L: N 488 m (1,600 ft)/min
SA 686 m (2,250 ft)/min
Service ceiling: N 4,575 m (15,000 ft)
Range with single pilot at 75% power at FL80, 45 min reserves, N:
standard fuel 450 n miles (833 km; 517 miles)
optional fuel 600 n miles (1,111 km; 690 miles)
g limits: SA ± 10

EXTRA EA-300 and EA-330

TYPE: Aerobatic two-seat sportplane.

PROGRAMME: Design began January 1987; first flight (D-EAEW) 6 May 1988; LBA certification 16 May 1990; certified FAR Pt 23 Amendment 33 Normal and Aerobatic categories for USA 26 February 1993; production started October 1988.

CURRENT VERSIONS: EA-300: Baseline, mid-wing, two-seat aircraft. Lateral vision panels in fuselage sides, below wing.

Details apply to Extra EA-300 except where indicated.



Extra EA-200 aerobatic sportplane (Paul Jackson)

1128906



Demonstrator Extra EA-300SP (Paul Jackson)

1158284



Extra 300L aerobatic sportplane flown by UK champion Mark Jeffries (Paul Jackson)

1128907

EA-300L: Low-wing, two-seat version with other structural changes; low wing enhances visibility during take-off and landing and eases installation of full IFR instrumentation; new ailerons give slightly higher roll rate (approximately 400°/s) and improved snap-rolling capability, both erect and inverted; shorter fuselage with all-composites side and belly access panels; cockpit interior modified for more comfort, with new reclined carbon fibre seats with optional leather trim; first aircraft (D-EUWH) delivered November 1994, FAA certification 31 March 1995. Current production version.

EA-300L Touring Edition: First shown (D-EDGE, c/n 1175) at ILA, Berlin, May 2004. Cost USD245,000. Features include leather seats with three-way adjustment, heater, high quality paint, electric rudder pedal adjustment and option of upgraded instrument panel.

EA-300LP: Improved version of EA-300L; announced 15 July 2005 and first aircraft, N202LP c/n 1202, displayed at EAA Air Venture, Oshkosh, later that month. P indicates 'performance'; redesigned engine cowlings for improved engine air flow; titanium firewall; and various weight reduction measures saving more than 14 kg (30 lb), including carbon fibre honeycomb fuselage shell; carbon fairings; titanium wheel and brake fairings; lightweight oil cooler; and Teflon hoses.

EA-300S: Single seat version of EA-300 with same power plant; wing shortened by 50 cm (19½ in) and more powerful ailerons; first flight (D-ESEW) 4 March 1992; certified March 1992; FAA certification 28 October 1993.

EA-300SP: Prototype single-seat 300SP (D-EXSS) flying by late 2005; cowling and weight modifications as EA-300LP. Further refined version for Red Bull Air Races to be designated EA-300LR.

EA-300SHP: Further upgrade of 300S for aerobatic pilot Mike Goulian; first aircraft, N821MG revealed May 2006. Weight reduced 45 kg (99 lb); empennage redesigned for increased agility; C of G moved aft.

EA-330LX: Strengthened version of EA-300L with CFRP fuselage panels, fin and rudder; wider-chord rudder and elevators, all with horn balances; 246 kW (330 hp) Textron

Lycoming AEIO-580 engine. Prototype (D-ESEW, modified from prototype EA-300S) first flown January 1998 and since converted to EA-330L. First production aircraft (D-EPET) flew 11 May 1998 and delivered to Hungarian aerobatic pilot Peter Besenyi, normally flown with single-seat cockpit canopy; first public performance at North Weald, UK, 29 May 1998. Third, D-EDGE (marked '300LX') built 1999; none further known.

EA-330XS: Designation applied to the former EA-300S (including D-EJKS of Aerobatics unlimited and N76PK of display pilot Gene Soucy) retrofitted with wide chord rudder.

CUSTOMERS: Total 66 (including prototype) two-seat original ('mid-wing') EA 300s delivered by April 1997; additional one to USA in November 1998. (One further, c/n 1068, laid down in 2005.) Further 28 EA-300Ss built by August 1995, plus additional ones in 1997, 1999, 2002, 2004 and 2005; two in first half of 2006; total 35, most recent being 300SP versions. EA-300L production totalled 232 by mid-2006, including 34 after re-formation of company. EA-330L/LX production two (excluding prototype). Thus, 308 of all EA-300/330 by early 2006. Total of eight were scheduled for production in 2003, then 36 in 2004, rising to maximum capacity of 48 in 2005, but targets only half achieved.

COSTS: Basic prices: EA-300L EUR215,000; EA-300SP EUR249,00 (both 2006).

DESIGN FEATURES: Designed for unlimited competition aerobatics; tapered, square-tipped mid-mounted wing with 4° leading edge sweepback; aerofoil symmetrical MA-15S at root, MA-12S at tip; no twist or dihedral.

FLYING CONTROLS: Conventional and manual. Rod and cable operated; nearly full-span ailerons, assisted by spade-type suspended tabs; trim tab in starboard elevator. Controls surface movements: ailerons $\pm 30^\circ$; elevators $\pm 26^\circ$; rudder $\pm 30^\circ$; trim tab $\pm 15^\circ$. Dual controls standard.

STRUCTURE: Fuselage (excluding tail surfaces) of steel tube frame with part aluminium, part fabric covering; wing spars of carbon composites and shells of carbon composite sandwich; tail surfaces of carbon spars and glass fibre shells.

LANDING GEAR: Non-retractable tailwheel type. Fuselage-mounted spring cantilever GFRP mainwheel legs each with single polyamide-faired wheel; leaf-sprung steerable tailwheel. Cleveland heavy-duty disc brakes.

POWER PLANT: One 224 kW (300 hp) Textron Lycoming AEIO-540-LIBS or AEIO-540-LIBSD flat-six engine, with Gomolzig exhaust, driving an MT-Propeller MTV-9-B-C/C200-15 three-blade, constant speed composites propeller with Woodward governor (four-blade MTV-14-B-C/C190-17 optional). With either standard or optional propeller and Gomolzig System 3 silencer, Extra 300s meet German and US noise limits. Christen Industries inverted oil system. Dual oil coolers standard. Fuel capacity 171 litres (45.1 US gallons; 37.6 Imp gallons), of which 165 litres (43.7 US gallons; 36.3 Imp gallons) usable; on EA-300L, 300LP, and 169 litres (44.6 US gallons; 37.2 Imp gallons) on EA-300S and 300SP; optional long-range tanks raise total fuel capacity to 208 litres (55.1 US gallons; 45.9 Imp gallons), of which 200 litres (52.8 US gallons; 44.0 Imp gallons) usable. Aerobatic category usable fuel restricted to 45 litres (12 US gallons; 10 Imp gallons) on EA-300L and 300SP, and 49 litres (12.9 US gallons; 10.8 Imp gallons) on EA-300S and 300SP.

ACCOMMODATION: Pilot and co-pilot/passenger in adjustable tandem composites seats under single-piece canopy opening to starboard; additional transparencies in lower sides of cockpit. Hooker harness with ratchet adjustment in rear seat. Electrically adjustable rudder pedals in rear cockpit.

SYSTEMS: 70 A alternator. Lightweight electric starter standard. Smoke system optional.

AVIONICS: To customer's choice, including Garmin GNS 430/530 GPS; Garmin 150XL or 250XL GPS/comm, Becker AR 4201 com/intercom with PTT switch; Bendix/King KT 76 or Garmin GTX 327 transponder; ELT with remote panel control; and David Clark or Bose Series II headsets.

Instrumentation: Dual ASIs and altimeters. Digital g-meter in front cockpit. Rear cockpit features as standard magnetic compass; manifold pressure/fuel flow indicator; digital tachometer with recording time; hours meter; digital accelerometer/g-meter; oil temperature/pressure gauge; CHT/EGT gauge; ammeter; alternator warning light. Optional instrumentation includes: front cockpit: slip indicator and analogue accelerometer; rear cockpit: VSI; turn-and-bank indicator; slip indicator for erect/inverted flight; DG; electric artificial horizon; Shadin Mini-Flow L fuel computer; and digital clock.

EQUIPMENT: Standard equipment includes stall warning system; wingtip strobe lights; tiedown rings; and external paint scheme in three colours. Optional equipment includes titanium firewall; brake fairings; leather seats and cockpit trim; Hooker harness with ratchet for front seat; canopy lock; single-seat canopy; cabin heater; removable aerobatic sequence card holder, 45/90° wingtip sighting devices; audio/video recording and downlink systems; battery charging system; external power socket; glider towhook; polyurethane tape wing walk protection; fitted airframe cover; custom exterior paint schemes.

DIMENSIONS, EXTERNAL:

Wing span: 300L	8.00 m (26 ft 3 in)
300LP, 300S, 300SP	7.50 m (24 ft 7¼ in)
Wing chord:	
at root: all	1.85 m (6 ft 0¾ in)
at tip: all	0.83 m (2 ft 8¾ in)
Wing aspect ratio, 300L	6.0
300LP, 300S, 300SP	5.3



First Extra EA-300SHP, flown by Mike Goulian

1159097



Extra EA-300LP 'performance' version (Paul Jackson)

1158285

EXTRA EA-400

TYPE: Business prop.

PROGRAMME: Announced February 1993; designed in collaboration with Delft University; first flight (D-EBEW) 4 April 1996; initial LBA certification to FAR Pt 23 received 23 April 1997. Second prototype (D-EGBU) flew April 1998, featuring downturned wingtips and ventral stake, both of which had been added to first aircraft before its retirement in 1997. This aircraft lost on delivery to first customer, 21 August 1998. FAA certification 15 April 1998.

CURRENT VERSIONS: **Extra EA-400:** As described.

Extra EA-500: Turboprop. Described separately.

CUSTOMERS: Two prototypes and 25 production aircraft completed by mid-2003; further one in 2004 by Extra Aircraft. Additional two airframes almost complete in 2004 but not flown by early 2006.

COSTS: Typically equipped, USD895,000 (2003).

DESIGN FEATURES: Cantilever high-wing NLF aerofoil section, T tail layout; spacious cabin; optimised for low internal and external noise.

FLYING CONTROLS: Conventional and manual. Frise ailerons, maximum deflections +27°/-19°; two-section electrically actuated Fowler flaps approximately two-thirds of span, deflection 0, 15 and 30°; horn-balanced elevators, maximum deflection +33°/-18°; trim tab in starboard elevator, maximum deflection +30°/-20°; rudder maximum deflection ± 25°; ground-adjustable tab on rudder. Interconnected aileron and rudder controls, with override. Electric pitch trim.

STRUCTURE: Composites throughout. Airframe consists of skin with integral longerons and frames. Wing built on double front spar and rear spar, interconnected by ribs; tailplane has front and rear spar. Skins generally of carbon fibre facings and honeycomb; longerons, frames, spars and ribs of carbon fibre with foam core; wing leading-edge of glass fibre with honeycomb and glass fibre ribs. Service life 25 years/20,000 hours/30,000 cycles/22,500 pressurisation cycles.

LANDING GEAR: Hydraulically retractable tricycle type; designed and manufactured by Gomolzig; single wheels throughout; main units retract forward into fuselage sides; nosewheel retracts rearwards. Mainwheel size 15x6.0-6, nosewheel size 5.00-5. Minimum turning radius 20.4 m (67 ft). Independent hydraulic brakes on mainwheels. Nosewheel steerable ±30°.

POWER PLANT: One 261 kW (350 hp) Teledyne Continental Voyager TSIOL-550-C six-cylinder turbocharged and intercooled liquid-cooled engine, with tuned exhaust system, driving an MT-Propeller MTV-14-D/195-30a four-blade, constant-speed (hydraulic) composites propeller; three-blade propeller optional. Fuel in two integral wing tanks, combined capacity 468 litres (123.6 US gallons; 102.9 Imp gallons), of which 404 litres (107 US gallons; 88.9 Imp gallons) are usable. Oil capacity 12.3 litres (3.2 US gallons; 2.7 Imp gallons).

ACCOMMODATION: Pilot and five passengers in pressurised cabin; four-way adjustable pilot's and co-pilot's seats; rear seats in club configuration; retractable shoulder harnesses for all occupants; single door on port side is horizontally split, with airstair in bottom half; top half hinges upwards. Emergency exit starboard side, opposite door. Cabin is heated and air conditioned with remote activation control, defrosting system and ventilation fan.

SYSTEMS: Electrical system 24 V, with direct-driven 28V 100 A alternator, belt-driven 85 A alternator and 24 V battery in tailcone. External power receptacle in tailcone. Pressurisation system, maximum differential 0.38 bar (5.5 lb/sq in). Wing and empennage leading-edges de-iced by Goodrich pneumatic estane (silver) inflatable boots.

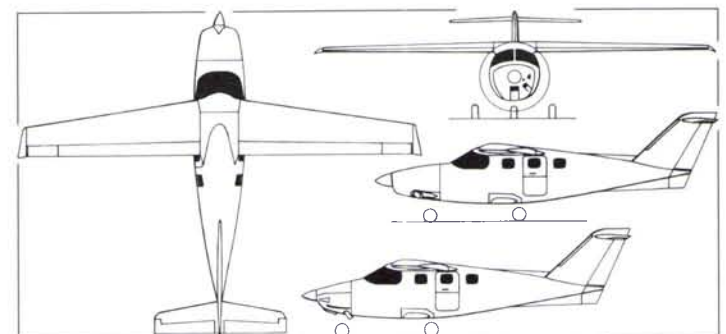
AVIONICS: Standard Garmin avionics suite, comprising GNS 530 and GNS 430 GPS/nav/coms, each with colour LCD MFD; GI-106A nav indicator with glideslope; GMA 340 audio panel with marker beacon receiver and six-place Bose X intercom interfaces; GTX 327 transponder; Honeywell EO461 EADI EFIS; Honeywell EADI EFIS attitude indicator; Litef LCR-92/CCU EA-85511 laser gyro platform; S-Tec 55X autopilot with altitude and vertical speed preselect, auto and command electric trim and electronic yaw trim; Pointer 3000 ELT; and Bose pilot's and co-pilot's headsets. Optional avionics include second GTX 327; GTX 330 Mode S transponder; remote-mounted Bendix/King KN 62 DME; Honeywell RDR-2000 colour weather radar in wingtip pod; Garmin GDL 49 weather uplink system; L-3 Communications Skywatch TCAS; and Aircell ACT02 voice/data system.

Instrumentation: Standard instrument includes dual ASIs, attitude indicators and directional gyros; pilot's Bendix/King KEA 130A encoding altimeter; co-pilot's standard altimeter; VSI; turn co-ordinator; magnetic compass; Moritz digital engine instrumentation system; Alcor CHT gauge; and master warning and annunciator panel. Options include EDM-800 graphic engine monitor with data recording facility, Thommen encoding drum altimeter; and Shadin air data computer.

EQUIPMENT: Standard equipment includes heated propeller, pilot's windscreen, pitot heads and stall vane; dual cockpit dome lights; multiple LED eyebrow panel lights; four overhead cabin reading lights; ice detection light; wingtip navigation and strobe lights; wing-mounted recognition lights; cowl-mounted landing light; grey leather seats and armrests; alcantara ultrasuede cabin headliner and sidewalls; grey chequerboard wool blends carpet; and stowaway writing desk. Options include video/audio entertainment cabinet (replaces one cabin seat); wood and carbon fibre cabin trim; cockpit/cabin privacy curtain; window shades; galley A-frame; golf bag restraint; cabin and engine preheat winter package; and pinstripes or customised exterior paint scheme.

DIMENSIONS, EXTERNAL:

Wing span	11.50 m (37 ft 8 3/4 in)
Wing aspect ratio	9.3
Length overall	9.56 m (31 ft 4 1/2 in)
Max width of fuselage	1.46 m (4 ft 9 1/2 in)
Height overall	3.09 m (10 ft 1 3/4 in)
Tailplane span	3.80 m (12 ft 5 1/2 in)



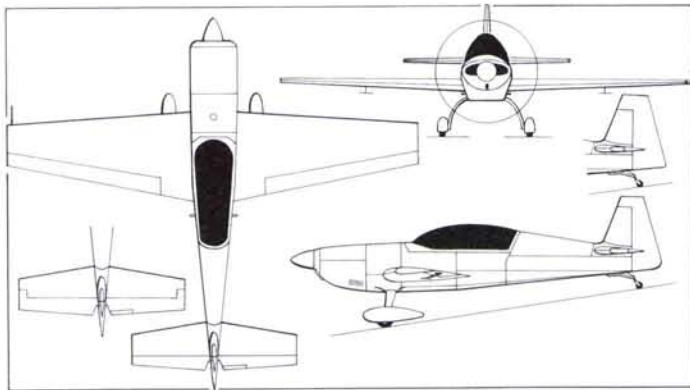
Extra EA-400 with additional side view (upper) of Extra EA-500 (Paul Jackson)

0137336



Extra 300 mid-wing version remains in limited production (Paul Jackson)

1158286



Extra EA-300L competition aerobatic aircraft, with scrap views of Extra 330 tail surfaces (James Goulding)

0064457

Length overall: 300, 300L, 300S, 300SP	6.96 m (22 ft 10 in)
Height overall: 300, 300L, 300LP, 300S, 300SP	2.60 m (8 ft 7 in)
Tailplane span: all	3.20 m (10 ft 6 in)
Wheel track: all	1.80 m (5 ft 10 3/4 in)
Propeller diameter: MTV-9	2.00 m (6 ft 6 3/4 in)
MTV-14	1.90 m (6 ft 2 3/4 in)
AREAS:	
Wings, gross: all	10.70 m ² (115.2 sq ft)
Ailerons, total: all	1.71 m ² (18.41 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty: 300L	672 kg (1,481 lb)
300LP	660 kg (1,455 lb)
300S, 300SP	629 kg (1,387 lb)
Max T-O weight:	
300L, 300LP Aerobatic, solo	820 kg (1,808 lb)
300L, 300LP Aerobatic, two-seat	870 kg (1,918 lb)
300L, 300LP Normal	950 kg (2,095 lb)
300S, 300LP Normal	920 kg (2,028 lb)
300S, 300SP Aerobatic Solo	820 kg (1,808 lb)
Max wing loading:	
300L, 300LP, 300S, 300SP, Aerobatic, solo	76.6 kg/m ² (15.69 lb/sq ft)
300L, 300LP, 300S, 300SP, Aerobatic, two-seat	81.3 kg/m ² (16.65 lb/sq ft)
300L, 300LP, Normal	88.8 kg/m ² (18.18 lb/sq ft)
300S, 300SP, Normal	86.0 kg/m ² (17.61 lb/sq ft)
Max power loading:	
300L, 300LP, 300S, 300SP, Aerobatic, solo	3.67 kg/kW (6.03 lb/hp)
300L, 300LP, 300S, 300SP, Aerobatic, two-seat	3.89 kg/m ² (6.39 lb/hp)
300L, 300LP, Normal	4.25 kg/m ² (6.98 lb/hp)
300S, 300SP, Normal	4.11 kg/m ² (6.76 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE), all	220 kt (407 km/h; 253 mph)
Max level speed: 300S	185 kt (343 km/h; 213 mph)
Max manoeuvring speed, all	158 kt (293 km/h; 182 mph)
Stalling speed:	
300L, 300LP at T-O weight 700 kg (1,543 lb)	55 kt (102 km/h; 64 mph)
300L, 300LP at T-O weight 950 kg (2,095 lb)	60 kt (111 km/h; 69 mph)
300S, 300SP at T-O weight 820 kg (1,808 lb)	55 kt (102 km/h; 64 mph)
300S, 300SP at T-O weight 920 kg (2,028 lb)	59 kt (110 km/h; 68 mph)
Max rate of climb at S/L:	
300L, 300S	975 m (3,200 ft)/min
Service ceiling: 300L, 300S	4,875 m (16,000 ft)
T-O run: 300L	115 m (375 ft)
T-O to 15 m (50 ft): 300L	248 m (815 ft)
Landing run: 300L	177 m (580 ft)
Range at 65% power cruising speed at FL80, 45 min reserves:	
300S	440 n miles (814 km; 506 miles)
Range at 45% power cruising speed, at FL80, 45 min reserves:	
300L, standard fuel	414 n miles (766 km; 476 miles)
300L, long-range fuel	510 n miles (944 km; 586 miles)
Endurance: 300S	2h 30 min
g limits: Aerobatic, solo	±10
Two-seat Aerobatic	±8



Extra EA-400 business prop (Paul Jackson)

1128908

Wheel track	2.20 m (7 ft 2½ in)
Wheelbase	2.56 m (8 ft 4¾ in)
Propeller diameter	1.95 m (6 ft 4¾ in)
Cabin door: Width	0.68 m (2 ft 2¾ in)
Height	1.15 m (3 ft 9¼ in)
DIMENSIONS, INTERNAL:	
Cabin (between forward and aft bulkheads):	
Length	4.11 m (13 ft 6 in)
Max width	1.40 m (4 ft 7 in)
Max height	1.22 m (4 ft 0 in)
AREAS:	
Wings, gross	14.26 m² (153.5 sq ft)
Horizontal tail surfaces	2.81 m² (30.25 sq ft)
Vertical tail surfaces	2.41 m² (25.94 sq ft)
WEIGHTS AND LOADINGS:	
Basic operating weight empty	1,389 kg (3,062 lb)
Baggage capacity	90 kg (198 lb)
Useful load	522 kg (1,150 lb)
Max T-O and landing weight	1,999 kg (4,407 lb)
Max zero-fuel weight	1,772 kg (3,907 lb)
Max wing loading	140.2 kg/m² (28.71 lb/sq ft)
Max power loading	7.66 kg/kW (12.58 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	221 kt (409 km/h; 254 mph) IAS
Manoeuvring speed	156 kt (289 km/h; 179 mph) IAS
Max cruising speed at 75% power at FL200	212 kt (393 km/h; 244 mph)
Econ cruising speed at 65% power at FL200	188 kt (348 km/h; 216 mph)
Stalling speed in landing configuration	59 kt (110 km/h; 68 mph)
Max rate of climb at S/L	326 m (1,070 ft)/min
Max certified altitude	7,620 m (25,000 ft)
T-O run	500 m (1,640 ft)
T-O to 15 m (50 ft)	860 m (2,820 ft)
Landing from 15 m (50 ft)	625 m (2,050 ft)
Landing run	275 m (900 ft)
Range, with reserves	1,060 n miles (1,963 km; 1,219 miles)
g limits	+4.0/-1.6

EXTRA EA-500

Engineering designation: EA-400-500

TYPE: Business turboprop.

PROGRAMME: Turboprop version of Extra EA-400; prototype (D-EKEW, later registered N501EX), employing previously reserved airframe, first flew 26 April 2002; damaged in forced landing during third sortie, 30 April 2002; announced at, but unable to participate in, Berlin Air Show 6 to 12 May 2002. Repaired and resumed flight testing within three months. Public debut at the NBAA convention in Orlando, Florida, 7 October 2003, at which time the prototype had flown some 70 hours, EASA day VFR certification achieved 16 July 2004. Second prototype, D-EHEW exhibited, unflown, at Friedrichshafen, April 2005; maiden flight was due in mid-2006. First deliveries were expected in June 2006.



Second Extra EA-500 when in use as static demonstrator (Paul Jackson)

1128909

CUSTOMERS: First year's production (unspecified) sold following NBAA debut in October 2003. Second aircraft, D-EHEW, completed in production configuration and exhibited statically in 2004 and 2005, with first flight expected in 2006.

Data generally as for Extra EA-400, except that below.

COSTS: USD1,495,000 (2003).

POWER PLANT: One 336 kW (450 shp) Rolls-Royce 250-B17F/2 turboprop, driving a five-blade MT-Propeller MTV-5-1-D-C-F-R(A)/CFR210-56 composites, constant-speed, reversible-pitch propeller with Woodward governor. Fuel in two integral tanks in wings, combined capacity, 680 litres (180 US gallons; 150 Imp gallons, of which 652 litres (172 US gallons; 143 Imp gallons) are usable.

ACCOMMODATION: Four-point pilot and co-pilot safety harnesses and three-point passenger harnesses, and baggage and cargo tiedowns, standard.

SYSTEMS: Electrical system has 28V 200A generator with long-life GCU automatic start and cut-off, 20A back-up alternator with regulator, and 24 V 28Ah battery in fire-resistant container. Cabin has bleed air heating and air conditioning and electrical defrosting system with ventilation fan, plus DC-powered air conditioning with external control. Goodrich pneumatic Estane/Teflon de-icing and heated propeller.

AVIONICS: Honeywell APEX as core system.

Comms: Garmin GMA 340 audio panel with MKR; Garmin GTX 327 transponder (Mode S); six-place intercom; dual Bose-X headsets; pilot and co-pilot PTT switches.

Flight: Garmin GNS 530 GPS/nav/com; GNS 430 GPS/nav/com with GI-106A nav display; Traffic advisory; EGPWS; Bendix/King KFC 225 flight director/autopilot. Optional TCAS, DME.

Instrumentation: Honeywell EHSI ED 461 EFIS and EADI attitude indicator. Two 264 mm (10.4 in) active matrix LCDs for PFD/MFD functions.

EQUIPMENT: Engine chip detector, and heated inlet ring, standard. Metallised exterior paint, optional.

DIMENSIONS, EXTERNAL:

Wing span	11.53 m (37 ft 10 in)
Length overall	10.10 m (33 ft 1½ in)
Height overall	3.40 m (11 ft 1¾ in)
Propeller diameter	2.00 m (6 ft 6¾ in)

DIMENSIONS, INTERNAL:

Cabin length	4.11 m (13 ft 6 in)
Cabin max width	1.40 m (4 ft 7 in)
Cabin max height	1.24 m (4 ft 1 in)

WEIGHTS AND LOADINGS:

Weight empty	1,445 kg (3,186 lb)
Max baggage weight	90 kg (198 lb)
Max T-O weight	2,130 kg (4,695 lb)
Max fuel weight	553 kg (1,220 lb)
Max zero-fuel weight	882 kg (1,945 lb)
Max landing weight	2,000 kg (4,409 lb)
Max wing loading: EASA	149.4 kg/m² (30.59 lb/sq ft)
Max power loading: EASA	6.35 kg/kW (10.43 lb/shp)

PERFORMANCE:

Never-exceed speed (VNE)	207 kt (383 km/h; 238 mph) IAS
Max operating speed	209 kt (387 km/h; 240 mph)
Manoeuvring speed	156 kt (289 km/h; 180 mph)
Cruising speed at mid-cruise weight:	
90% power at FL120	226 kt (419 km/h; 260 mph)
75% power at FL250	200 kt (370 km/h; 230 mph)
40% power at FL250	173 kt (320 km/h; 199 mph)
Stalling speed	61 kt (113 km/h; 71 mph)
Max rate of climb at S/L	407 m (1,335 ft)/min
Max certified altitude	7,620 m (25,000 ft)
T-O run	381 m (1,250 ft)
T-O to 15 m (50 ft)	625 m (2,050 ft)
Landing from 15 m (50 ft)	610 m (2,000 ft)
Landing run	259 m (850 ft)
Range, with reserves:	
204 kg (450 lb) useful load	1,600 n miles (2,963 km; 1,841 miles)
363 kg (800 lb) useful load	1,000 n miles (1,852 km; 1,151 miles)
454 kg (1,000 lb) useful load	700 n miles (1,296 km; 805 miles)
Endurance:	
at 90% power	4 h 6 min
at 75% power	7 h 36 min

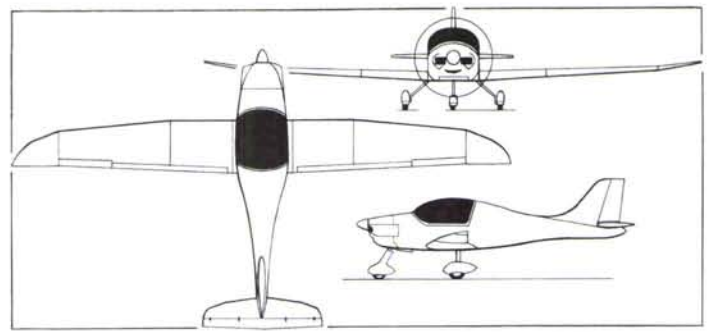
FLÄMING AIR

FLÄMING AIR GMBH

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 CHIEF EXECUTIVE: Rudi Hackel

In addition to operating a flying school and air charter business, Fläming Air imports and sells Eastern European aircraft to the German market. These include the ATEC Zephyr, Urban Lambáda/Samba, Podešva Trener Baby, which is marketed under the Fläming Air name, although built in the Czech Republic, and a two-seater originally known as the FSU Saphir.

In late 2003, the company announced it was preparing to fly the FA 02 Smaragd, an ultralight motorglider based on the Saphir. By mid-2004, however, this had been renumbered FA 03, the Saphir being retrospectively designated FA 01 Smaragd and FA 02 Smaragd VLA.



Fläming Air FA 01 Smaragd (Rotax 912 UL four-stroke (James Goulding))

1159381

FLÄMING AIR FSU SMARAGD

English name: Emerald

TYPE: Side-by-side ultralight/kitbuilt.

PROGRAMME: Incomplete prototype of aircraft then known as Saphir (Sapphire) exhibited at Aero 2001 at Friedrichshafen in April 2001; first flight then scheduled for August or September 2001; D-MATR exhibited at Berlin, May 2002. Certification to LTF-UL regulations received in late 2003, at which time a second prototype was nearing completion.

Renamed Smaragd in mid-2004, coincident with upgrade including adjustable seats, individual mainwheel brakes, new instrument panel and strengthened canopy with increased opening angle.

CURRENT VERSIONS: FA 01 Smaragd 80: Ultralight version; as described.

FA 01 Smaragd K: Short (*kurze*) wing ultralight; span 8.80 m (28 ft 10½ in); wing area 8.52 m² (91.7 sq ft). Any engine option.

FA 01 Smaragd 100: As Saphir 80 but with 73.5 kW (98.6 hp) Rotax 912 ULS for glider- and banner-towing.

FA 01 Smaragd J: As Saphir 80 but with 59.7 kW (80 hp) Jabiru 2200.

FA 01 Smaragd D: Proposed version with 59.7 kW (80 hp) Diesel Air D-280.

FA 02 Smaragd VLA: Kitbuilt lightplane version to JAR-VLA; empty weight 340 kg (750 lb) maximum T-O weight 600 kg (1,322 lb); span and wing area as Smaragd K. Prototype D-EERJ (with 78.9 kW; 58.8 hp Diesel-Air D-280 engine) exhibited incomplete at Berlin, May 2004, then known as Super Saphir.

Smaragd Experimental: Generally as VLA, but with K (short) wing, except petrol engine, MTOW 650 kg (1,433 lb) and increased empty weight of 350 kg (772 lb).

CUSTOMERS: First two aircraft completed in 2003. Seven sold in Germany in 2004. At least nine FA 01s and 23 FA 02s produced by 2006.

COSTS: Kit: Smaragd 80 EUR65,500; Smaragd 100 EUR66,500; Smaragd J EUR64,500 (including instruments and taxes) (all 2005). Flyaway prices on application.

DESIGN FEATURES: Low-wing monoplane with slightly sweptback wings and upturned wingtips; winglets optional. Combines elements of two Czech aircraft: wing and tail unit of Urban UFM 10 Samba with cockpit section of ATEC Zephyr, both of which are described in the Czech Republic section. Urban Samba XXL has same combination, but detail differences.

Wing section SM 701.

FLYING CONTROLS: Conventional and manual. One-piece elevator; plain flaps. Electrically actuated elevator trim tab and flaps.

STRUCTURE: All-composites.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring cantilever mainwheel legs. Mainwheel diameter 400 mm, nosewheel 300 mm. Hydraulic brakes. Speed fairings on all three wheels.

POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL (Smaragd 80), 73.5 kW (98.6 hp) Rotax 912 ULS (Smaragd 100) or 59.7 kW (80 hp) Jabiru 2200, driving a Kremen SR 200 three-blade, ground-adjustable pitch wooden propeller; optional Kremen SR 2000 variable-pitch (electric), wooden propeller. Smaragd D offered with 59.7 kW (80 hp) Diesel Air



Fläming Air FA 01 Smaragd with winglet option (Paul Jackson)

1159346

FLÄMING AIR FA 03 SMARAGD TMG

English name: Emerald

TYPE: Side-by-side ultralight motor glider kitbuilt.

PROGRAMME: Announced late 2003; partly complete prototype (subsequently D-KERH) exhibited at ILA, Berlin, May 2004, when first flight planned for two months later. Not flown, however, and empennage redesigned before appearance at ILA, Berlin, May 2006, at which time first flight was scheduled for late 2006.

COSTS: Kit estimated EUR60,000, less engine; flyaway EUR95,000 incl tax (2006).

DESIGN FEATURES: Development of company's FA 01/02 Smaragd lightplane with stretched fuselage, T tail, tailwheel and increased wingspan. Laminar profile wing.

Data generally as for Smaragd, except that below.

FLYING CONTROLS: Conventional and manual. Airbrakes.

STRUCTURE: Composites wing with carbon fibre reinforcement and landing edge; glass fibre and carbon fibre fuselage.

LANDING GEAR: Mainwheels 360x120; tailwheel 210x50.

POWER PLANT: Optimised for 73.5 kW (98.6 hp) Rotax 912 S piston engine and Mühlbauer propeller.

Fuel in two wing tanks, combined capacity 120 litres (31.7 US gallons; 23.4 Imp gallons).

DIMENSIONS, EXTERNAL:
 Wing span 16.00 m (52 ft 6 in)
 Length overall 7.40 m (24 ft 3¼ in)
 Height overall 1.53 m (5 ft 0¼ in)

AREAS:
 Wings, gross 13.60 m² (146.4 sq ft)

WEIGHTS AND LOADINGS:
 Weight empty 400 kg (882 lb)
 Max T-O weight 650 kg (1,433 lb)

PERFORMANCE:
 Cruising speed at 75% power 108 kt (200 km/h; 124 mph)
 Stalling speed 41 kt (75 km/h; 47 mph)



Fläming Air FA 03 Smaragd in its 2006 guise with T tail (Paul Jackson)

1159347

FLIGHT DESIGN

FLIGHT DESIGN GMBH
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e-mail: info@flightdesign.com
Web: www.flightdesign.com
MANAGING DIRECTOR: Matthias Betsch

PRODUCTION CENTRE:
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Avia-pro Ltd, 82a Rabochaya, 73009 Kherson, Ukraine
Tel: (+38 55) 238 04 00 or 04 10
Fax: (+38 55) 238 04 20
e-mail: orders@Avia-pro.com.ua
DIRECTOR: Alexandre Nieprimitz

Flight Design's current product is the CT. Fabrication of parts is at Flight Design's 40,000 sq ft (3,715 m²) Ukrainian factory producing composites to German specifications. In 2005, Flight Design had a workforce exceeding 280 and was also involved in the engineering and production of paragliders. Sales in US during 2005 of 70 aircraft (of which 45 delivered) prompted near doubling of capacity, with 220/240 scheduled for manufacture in 2006.

FLIGHT DESIGN CT

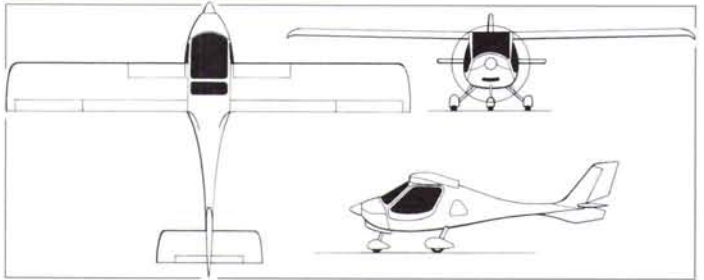
TYPE: Two seat lightplane; side by side ultralight.
PROGRAMME: Original CT version certified in Germany on 6 June 1997, having flown some 1,000 hours. CT and kitbuilt CTX version now discontinued.
CURRENT VERSIONS: **CT2K:** Standard version, as described. Lighter airframe; downturned wingtips; German certified maximum T-O weight increased to 472.5 kg (1,042 lb) in October 2003.
CTU: Longer span version to achieve 38 kg/m² (7.78 lb/sq ft) wing loading required in some countries; extra 1.00 m (3 ft 3/4 in) span and 1.20 m² (12.9 sq ft) increase in area; available to order only.
CTsw: Short span version (8.53 m; 28 ft), max T-O weight 472.5 kg (1,042 lb). First exhibited at Berlin in May 2004. Approved for US LSA and imported into US prior to, and in parallel with, CTsw 2006.
CTsw 2006: US LSA approved version launched at Sun 'n' Fun, Lakeland, Florida, 4 to 10 April 2006. Fin chord increased; weight empty 300 kg (661 lb) including parachute; MTOW 598 kg (1,320 lb); reinforced landing gear. Standard equipment includes BRS 1350 ballistic recovery parachute; 6.00-4 mainwheels and 5.00-4 nosewheel; strobe and position lights and various avionics packages including EFIS with Dynon D100 screen port, D120 starboard, Garmin GPSMap 396, Bendix/King KY 97A radio and KT76A transponder, plus standby gauges. Never-exceed speed 145 kt (268 km/h; 166 mph); stalling speed 44 kt (82 km/h; 51 mph) clean, 39 kt (73 km/h; 45 mph) flaps down. EFIS-equipped cost USD111,000 flyaway; basic USD89,900.
CUSTOMERS: More than 600 of all versions built by April 2006.
COSTS: Complete, with Rotax 912 UL-2, propeller and Junkers ballistic recovery system EUR61,480 excluding tax (2004). Kits no longer available.
DESIGN FEATURES: Optimised for safe handling, speed and range. High-mounted, cantilever, constant chord wing, sharply waisted fuselage and sweptback fin with large underfin. CT2K features new trim tab and optional downturned wingtips.
Wing dihedral 1° 40'; no incidence, twist or washout.
FLYING CONTROLS: Conventional ailerons and horn balanced rudder, manually actuated; anti-moving tailplane with anti-balance tab. Externally-hinged slotted ailerons. Electrically actuated plain flaps, deflection -12° and +40°; internal (external on early aircraft) mass balances for ailerons and tailplane.
STRUCTURE: Principally of composites, including carbon/glass fibre and carbon/aramid sandwich construction.
LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, forward-swept spring aluminium tube cantilever mainwheel and nosewheel legs; steerable nosewheel. Mainwheels typically 4.00-6; nosewheel 4.00-4. Optional speed fairings on all wheels. Hydraulic mainwheel brakes.
POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL-2 or 73.5 kW (98.6 hp) Rotax 912 ULS flat four, driving a Neuform two blade C2 V variable-pitch or C2 fixed-pitch propeller. Fuel in two wing leading edge tanks, combined capacity 130 litres (34.3 US gallons; 28.6 Imp gallons).
ACCOMMODATION: Two persons, side by side; dual controls; upward-hinged door with gas spring for each occupant. Baggage space behind seats, with external door on each side.



Flight Design CTsw two-seat lightplane and ultralight (Paul Jackson) 1158007



Typical instrument panel of CT SW 2006, including twin Dynon EFIS screens (D100, port, and D120) and GPSMap 396 (Paul Jackson) 1158009



General arrangement of the Flight Design CT2K (James Goulding) 0110593

AVIONICS: Optional avionics include Honeywell KY97A com, KX 125 nav/com, KT 76A Mode A/C transponder, Skyforce IIC GPS, Flightcom headsets and ELT.
Instrumentation: Winter variometer and Rotax FlyDat engine management system optional.
EQUIPMENT: Optional equipment includes cabin comfort pack; anti-collision and position lights; and Junkers High Speed or BRS UL 1050 ballistic parachute recovery systems.
DIMENSIONS, EXTERNAL:
Wing span: CT 2K 9.31 m (30 ft 6½ in)
 CTsw 8.53 m (27 ft 11¾ in)
Wing chord, constant: both 1.17 m (3 ft 10 in)
Wing aspect ratio 8.0
Length overall 6.215 m (20 ft 4½ in)
Height overall 2.165 m (7 ft 1¼ in)



CTsw 2006 displaying increased rudder chord of this version 1158008

Tailplane span	2.38 m (7 ft 9 3/4 in)
Tailplane chord	0.70 m (2 ft 3 1/2 in)
Wheel track	1.70 m (5 ft 7 in)
Wheelbase	1.45 m (4 ft 9 in)
Propeller diameter	1.73 m (5 ft 8 in)
Propeller ground clearance	0.28 m (11 in)

DIMENSIONS, INTERNAL:

Cabin max width	1.24 m (4 ft 0 3/4 in)
-----------------------	------------------------

AREAS:

Wings, gross: CT2K	10.80 m ² (116.3 sq ft)
CTsw	9.98 m ² (107.4 sq ft)
Ailerons (total): CT2K	0.98 m ² (10.55 sq ft)
CTsw	0.80 m ² (8.61 sq ft)
Flaps (total)	1.51 m ² (16.25 sq ft)
Fin and rudder (total)	1.14 m ² (12.27 sq ft)
Tailplane (total incl elevators and tab)	1.65 m ² (17.76 sq ft)

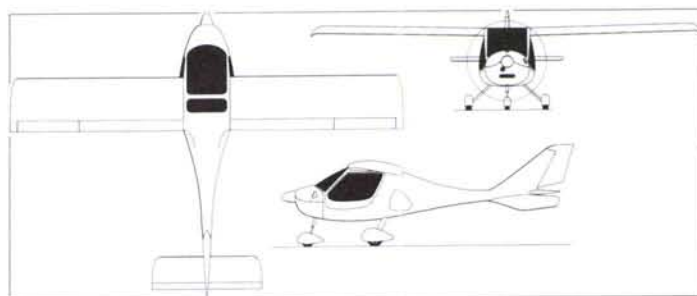
WEIGHTS AND LOADINGS:

Weight empty	262 kg (578 lb)
Max T-O weight	600 kg (1,322 lb) ¹
Max baggage weight	60 kg (132 lb)
Max wing loading: CT2K	55.6 kg/m ² (11.38 lb/sq ft)
CTsw	60.1 kg/m ² (12.31 lb/sq ft)
Max power loading: 912 UL	10.07 kg/kW (16.54 lb/hp)
912 ULS	8.16 kg/kW (13.41 lb/hp)

¹ or 472.5 kg (1,042 lb) to meet national limits

PERFORMANCE (downturned wingtips, A: 912 UL; B: 912 ULS):

Never-exceed speed (VNE): A, B	167 kt (310 km/h; 192 mph) IAS
Max level speed: A, B	146 kt (270 km/h; 168 mph) IAS
Cruising speed at 75% power:	



Flight design CTsw 2006 (Paul Jackson)

1158032

A	121 kt (225 km/h; 140 mph) IAS
B	127 kt (235 km/h; 146 mph) IAS
Stalling speed at 450 kg (992 lb) MTOW:	
A, B	34 kt (62 km/h; 39 mph) IAS
Service ceiling: A, B	4,270 m (14,000 ft)
Max rate of climb at S/L: A	210 m (689 ft)/min
B	300 m (984 ft)/min
T-O run	90 m (295 ft)
T-O to 15 m (50 ft)	160 m (525 ft)
Range with max fuel, 30 min reserves	1,079 n miles (2,000 km; 1,242 miles)
g limits: A, B:	
at 450 kg (992 lb) MTOW	+6
at 600 kg (1,322 lb) MTOW	+4.3

FLUG WERK

FLUG WERK GMBH

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DIRECTOR: Claus Colling

Formed on 13 June 1996 and specialising in the reproduction of classic German aircraft, Flug Werk plans to augment its Fw 190 project with resumed manufacture of the Messerschmitt Bf 109 (for which it produces 'spare' parts for existing aircraft) and wings for the P-51 Mustang. A Heinkel He 112 replica was reported to be under consideration, but no further news has been received of this project or the planned Arado Ar 96B reproduction, the latter known to have been suspended in 2003. New 600 m² (6,450 sq ft) hangar inaugurated 31 March 2000; this has been outgrown and the company is looking to move to Ingolstadt/Manching, where it has hired hangar space before constructing new facilities.

It was at Ingolstadt on 22 July 2004 that the first Fw 190 was flown. Other recent activities include repair of a genuine Bf 109G after a taxiing accident, overhaul of a North American T-6 and construction of components for the P-51 Mustang and plans to market a kit of the P-51 Mustang under the designation AP-51 Palomino. Company is capable of building complete replacement wings and fuselages for Mustangs and can supply major components for Bf 109 restorations. Earlier work on Fw 190s included refurbishment of WNr 173056, a genuine aircraft belonging to Don Hansen of Baton Rouge, Louisiana, for which an ASH-82 engine conversion kit was also engineered and supplied.

In late 2004, FW received airframes of one Bf 109E and one Bf 109F for restoration, the latter to be reverse-engineered for subsequent manufacture of further airframes with new DB 601 engines. A less complete Bf 109G-2 was also received in 2004 for restoration and resale on behalf of a third party. A North American T-28 Trojan was being overhauled in 2004-05 and a Fouga CM170 Magister has also been completed.

Co-director Hans Günther Wildmoser died in September 2003.

FLUG WERK FW 190

TYPE: Single-seat sportplane kitbuilt.

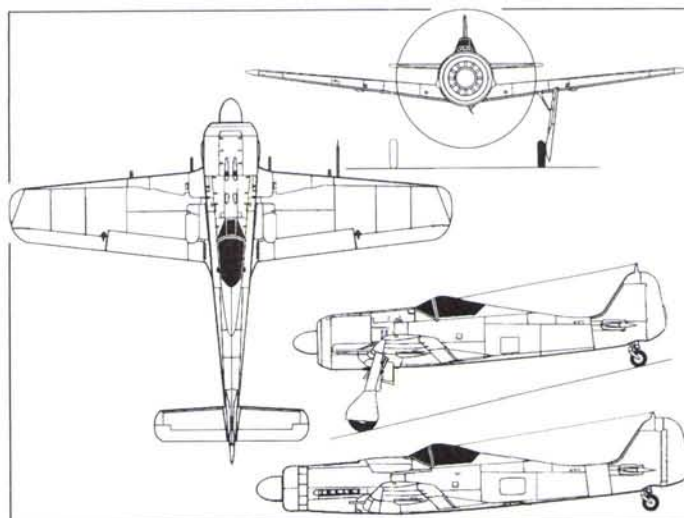
PROGRAMME: Flug Werk GmbH started assembling a batch of 12 Focke-Wulf Fw 190 Second World War fighters in June 1996, these to be in FW 190A-8/N and FW 190D-9/N configurations, their /N designation indicating *nachbau*: replica. Components are being manufactured in seven countries (principally in Romania by Aerostar) from original drawings, resulting in airframes said to be 98 per cent faithful to the original.

Power plant of the 10 A-8s is a 1,400 kW (1,877 hp) ASH-82FN 14-cylinder twin-row



Flug Werk FW 190 prototype after repainting in Second World War colours

1133384



Focke-Wulf Fw 190A, with additional side view of Fw 190D (Paul Jackson)

1159382

radial engine, a Russian version of the original BMW 801D, driving a three-blade, 3.30 m (10 ft 10 in), constant-speed MT wood/composites propeller. The first aircraft (WNr 8900001, D-FWWC) shown statically, April 2000, but due to integration problems with the power plant, first engine runs were postponed to the third quarter of 2002; first flight was planned for August 2003, but not achieved until 22 July 2004. Three FW 190A-8/Ns will be sold in Europe, the remaining seven going to the USA, South Africa and Australia; all had found firm buyers by early 2002. Price for kits (including engine, but not avionics, instruments, oxygen system, electrical wiring looms or paint) is EUR555,000 ex-works (2004).

FW-built aircraft are 450 kg (992 lb) lighter than the original, due to omission of military items, and carry 880 litres (232 US gallons; 194 Imp gallons) of fuel – an increase of 230 litres (61 US gallons; 51 Imp gallons) – although they are otherwise 98 per cent faithful to the original, including genuine Second World War tailwheel assemblies discovered in storage; Boeing 737-400 nosewheel assemblies and tyres are used for the FW190's mainwheels.

The remaining two aircraft, advertised in 2002, are the long-nose Fw 190D-9/N 'Dora', the original having a 1,402 kW (1,880 hp) Jumo 213; the new aircraft having a specially modified Allison V-1710 V-12 engine.

Brief data for new-built FW 190A include:

DIMENSIONS, EXTERNAL:

Wing span	10.50 m (34 ft 5 1/2 in)
Length overall	9.10 m (29 ft 10 1/4 in)
Height overall, fuselage	3.95 m (12 ft 3 3/4 in)

AREAS:

Wings, gross	18.300 m ² (197.0 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	2,900 kg (6,393 lb)
Max T-O weight	3,800 kg (8,377 lb)

PERFORMANCE:

Max level speed at FL200	343 kt (635 km/h; 395 mph)
Cruising speed at 2,300 rpm	316 kt (585 km/h; 364 mph)
Unstick speed	89 kt (165 km/h; 103 mph)
Approach speed	100 kt (185 km/h; 115 mph)
Initial rate of climb at S/L	1,219 m (4,000 ft)/min
Range, VFR reserves	534 n miles (990 km; 615 miles)

GEFA-FLUG

GESELLSCHAFT ZUR ENTWICKLUNG UND FÖRDERUNG
AEROSTATISCHER FLUGSYSTEME GMBH
(AEROSTATIC FLIGHT SYSTEMS DEVELOPMENT AND
PROMOTION COMPANY)

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MARKETING DIRECTOR: W Mainzer
SALES DIRECTOR: J Leisten

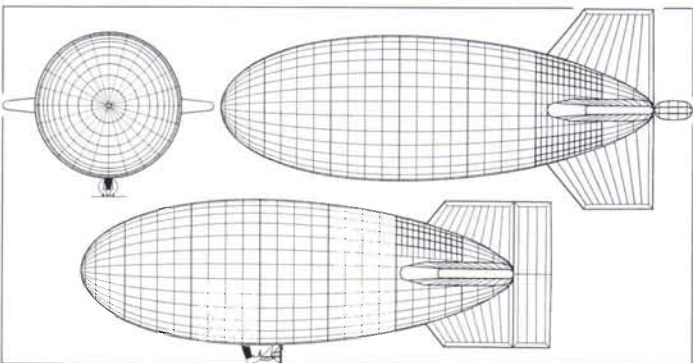
GEFA-Flug was established 1975 to operate advertising and passenger-carrying hot-air balloons; has R&D department to develop airships for manned and unmanned civil and environmental research applications such as aerial photogrammetry and pollution monitoring. Company currently operates more than six hot-air balloons, hot-air airships and a number of remotely controlled aerostats, and has sold about 100 systems (mostly unmanned and remotely controlled) worldwide. Is current manufacturer of former Colt AS 105 GD hot-air airship. Future market seen as survey projects for environmental research: GEFA-Flug also developing scientific measuring equipment in partnership with German Mining Technology, a partly government-funded body.

GEFA-FLUG AS 105 GD

TYPE: Hot-air non-rigid.
PROGRAMME: Modified version of AS 105 Mk II first flown 1990 and built until 1994 by Thunder & Colt (and Cameron) in UK; German development began 1993. Certification (by UK CAA) and first production AS 105 GD completed in 1996; certified by German LBA on 29 December 1999, this being transferred to EASA on 2 June 2005 for daytime VFR flight.
CUSTOMERS: Total of 19 built in Germany by early 2005 (see table), of which at least eight (from 2000 onwards) have German-certified four-seat gondolas. GEFA-Flug assigns unified sequence of campaign numbers, which include allocations to UK-built AS 105s imported (and re-imported) for specific contracts. Campaign number H00037 was completed on 23 November 2005.

GEFA-FLUG HOT AIR NON-RIGIDS

Campaign No.	c/n	Constructor	Registration and name	Remarks
H0001	1641	T&C	D-GEFAFLUG/ Adler(1)	ex G-BSLY
H0002	2372	T&C	D-ORCA/Adler(2)	
H0003	3685	Cameron	G-BWKE/Banner(1)	
H0004	1999	T&C	G-BTSW/Adler(3)	
H0005	3936	T&C	G-BXEY/Banner(2)	
H0006	0006	G-F	D-OCAC/Warsteiner(1)	
H0007	1578	Cameron	G-BROL/Warsteiner(2)	
H0008	4231	Cameron	G-BXNV/Bodytone	
H0009	0009	G-F	D-ODAT/Adler(4)	
H00010	4433	Cameron	G-BXYF/Volkswagen	
H00011	3775	Cameron	G-BWMV/Opel	
H00012	1501	Cameron	G-OVAX/Banner(3)	
H00013	not used			
H00014	0014	G-F	HB-QIQ/Warsteiner(3)	ex D-OGAC
H00015	0015	G-F	D-OKFP/Warsteiner(4)	
H00016	0016	G-F	D-OZDP/Deutsche Post(1)	
H00017	0017	G-F	D-OLMW/Möbel- Walther	
H00018	0018	G-F	D-OMMU/Möbel- Mutschler	



GEFA-Flug AS 105 GD hot-air non-rigid airship (Paul Jackson)

1046948

Campaign No.	c/n	Constructor	Registration and name	Remarks
H00019	0019	G-F	D-OHHO/Festo(1)	
H00020	1999	T&C	G-BTSW/Adler(5)	see H0004
H00021	0021	G-F	I-NORGI/Tim	ex D-OATV/G- BZUR
H00022	0022	G-F	D-OTTA/Banner(4)	
H00023	0023	G-F	D-OLFI/WDR2	
H00024	0024	G-F	D-OEBW/EnBW	
H00025	0025	G-F	D-OZDQ/Deutsche Post(2)	
H00026	0026	G-F	HB-QIP/Zuger- Kantonalbank	
H00027	0027	G-F	D- Deutsche Post(3)	
H00028	0028	G-F	D-ORTA/Ratiopharm	
H00029	0029	G-F	D-OHHH/Festo(2)	
H00030	0030	G-F	D-OAVE/Linde	
H00031	0031	Cameron	G-CDFT	
H00032	0032	G-F	D-OTHS/Thomapyrin	

Notes: All are AS 105 GD except H0001 and H0002, which are AS 80 GD. Constructors are Thunder & Colt, Cameron and GEFA-Flug

COSTS: Development programme DM1.4 million; standard airship approximately EUR160,000 (2002).
DESIGN FEATURES: Longer and slimmer envelope than UK-built version; cruciform tail surfaces with rudder on each vertical fin; twin catenary load suspension system distributes loads of gondola weight and power plant forces evenly into envelope.
FLYING CONTROLS: Burners located inside envelope and operated electrically, with manual override; pilot lights fitted with electric spark and piezoelectric ignition, specially modified to operate directly underneath inflation fan without blowing out; steering by rudder on each vertical fin, operated by cables connecting them to gondola.
STRUCTURE: Envelope made from Carrington Hyperlast high-tenacity and high temperature-resistant fabric; engine drives generator supplying electric fan used to pressurise envelope; additional air for envelope pressurisation via scoop located in propeller slipstream. Gondola is a chromoly aircraft-grade steel tube spaceframe with Macrolon skin panels; windscreen, of polycarbonate sheet, forms partially enclosed cockpit.
LANDING GEAR: Non-retractable; two front and two rear wheels; spring shock-absorbers.
POWER PLANT: One 47.8 kW (64.1 hp) Rotax 582 UL two-cylinder water-cooled engine, driving a Helix four-blade carbon fibre pusher propeller. Fuel capacity 28 litres (7.4 US gallons; 6.2 Imp gallons). Cameron Mk 4 Shadow double gas burner for hot air generation.
ACCOMMODATION: Pilot, co-pilot and two passengers in pairs. Optionally (originally) two persons in tandem.
AVIONICS: Comms: Dittel FSG 71 720-channel VHF transceiver; FSG 2T transponder optional. Instrumentation: Standard VFR.



GEFA-Flug AS 105 GD with four-seat gondola

1128939

DIMENSIONS, EXTERNAL:

Envelope: Length overall	41.00 m (134 ft 6¼ in)
Max diameter	12.80 m (42 ft 0 in)
Fineness ratio	3.2
Tail unit span	18.00 m (59 ft 0¾ in)
Propeller diameter	1.60 m (5 ft 3 in)
Propeller ground clearance	0.10 m (4 in)

DIMENSIONS, INTERNAL:

Envelope volume	2,973 m³ (105,000 cu ft)
Gondola cabin: Length	4.00 m (13 ft 1½ in)
Max width	1.60 m (5 ft 3 in)
Max height	1.80 m (5 ft 10¾ in)

WEIGHTS AND LOADINGS:

Weight empty	approx 450 kg (992 lb)
Max T-O weight: two-seat	850 kg (1,873 lb)
four-seat	900 kg (1,984 lb)

PERFORMANCE:

Max level speed	22 kt (40 km/h; 25 mph)
Max cruising speed	20 kt (37 km/h; 23 mph)
Econ cruising speed	15 kt (28 km/h; 17 mph)
Max rate of climb at S/L	183 m (600 ft)/min
Endurance: with max payload	1 h
with pilot only	3 h

GERMAN AIRCRAFT

GERMAN AIRCRAFT GMBH

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CEO: Ralf Voigt

German Aircraft has taken over production and sales of the SAI G97 Spotter, previously produced in Italy; the product has been retitled Sky-MAXX. The company plans to raise further funds with a share issue in 2008

GERMAN AIRCRAFT SKY-MAXX

TYPE: Multisensor surveillance lightplane; side-by-side ultralight kitbuilt.
PROGRAMME: Design, by SAI of Italy, began June 1997; construction of prototype G97 ultralight started November 1997; first flight June 1998, powered by 47.8 kW (64.1 hp) Rotax 582; first G97V lightplane (I-OPIS) had public debut at Aero '01, Friedrichshafen, in April 2001 and first flew 15 May 2001. Construction of first production G97 began September 2000; initial flight March 2001. Certification of G97V was due late 2001, that for Germany awarded March 2006. Purchase of programme by German Aircraft has resulted in no distinction between lightplane and ultralight versions.

CURRENT VERSIONS: **Sky-MAXX (former G97V Spotter):** Certified light aircraft to Italian ENAC V.E.L (elementary aircraft) standard. Differs from G97 prototype in having stretched forward fuselage.

Sky-MAXX (former G97 Spotter): As above, but in Ultralight category; assembled from kit.

CUSTOMERS: Six aircraft of all versions (including prototypes) flying by September 2001. Total 30 delivered to Italy, South America, South Africa, Spain and USA by mid-2003. German production was due to start in 2006.

COSTS: Sky-MAXX kit USD49,500; ready-to-fly USD99,700 with Rotax 912UL. (2006).

DESIGN FEATURES: Advanced ultralight able to transition to certified aircraft category; intended for police/civil protection agency use, with helicopter-like view for crew assured by pusher propeller, side-by-side seating and absence of wing external bracing. Also suitable for private flying, training and light transport. Prime design objectives included sacrifice of speed to ensure utility; configuration overcomes related problems of ground cooling for engine, aerodynamic balance with large CG range, comfort in turbulent air and cabin noise. Computer modelling used in design, particularly with pod/boom interface and aerofoil tested in Department of Aircraft Design, Naples University.

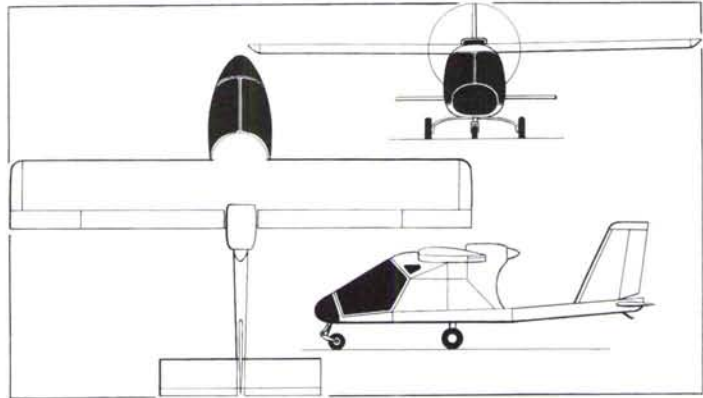
Pod-and-boom fuselage; cantilever, constant chord wings, detachable for storage. Sweptback fin; tailplane below propeller slipstream.

German Aircraft quoted build time of 120 hours for kit.

Purpose-designed Giordano VG1-13H high-lift aerofoil; no sweep; no twist; thickness-chord ratio 13.1 per cent; dihedral 1°; incidence 2° 30'.

FLYING CONTROLS: Manual. Frise differential ailerons, rudder and all-moving tailplane with anti-balance tab and electrically actuated trim. Electrically actuated slotted flaps on 71 per cent of wing trailing-edge.

STRUCTURE: Mostly aluminium alloy structure and skin, except rudder and part of tailplane Dacron covered; wing/fuselage fairing, wingtips and tailcone of glass fibre.



German Aircraft Sky-MAXX (James Goulding)

1159392

LANDING GEAR: Tricycle type; fixed. Cantilever-sprung mainwheel legs of single carbon fibre/glass fibre piece, attached to fuselage by four bolts. Nosewheel with rubber shock-absorber. Hydraulic disc brakes on mainwheels operated by lever in cockpit. Steerable nosewheel. Main tyres size 6.00-5; nose 11x4.00-5.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS flat-four driving a Tonini two-blade, wooden propeller of 1.44 m (4 ft 8½ in) pitch. Two wing leading-edge fuel tanks in early aircraft, combined capacity 70 litres (18.5 US gallons; 15.4 Imp gallons), of which 66 litres (17.4 US gallons; 14.5 Imp gallons) are usable. By 2003, fuel capacity increased to 90 litres (23.8 US gallons; 19.8 Imp gallons). Option of 74.0 kW (99 hp) Hirth 3701ES, and three-blade Helix propeller in later versions. Jabiru J2200 (59.7 kW; 80 hp), Jabiru J3300 (89.5 kW; 120 hp).

ACCOMMODATION: Two persons, side by side, with four-point harnesses. Upward-opening door each side. Dual controls, including central throttle; ventilation. Baggage compartment behind seats.

SYSTEMS: Electrical system has 12 V battery and 100 W alternator. Optional BRS ballistic recovery parachute.

AVIONICS: To customer's requirements.

DIMENSIONS, EXTERNAL:

Wing span	8.25 m (27 ft 0¾ in)
Wing chord, constant	1.25 m (4 ft 1¼ in)
Wing aspect ratio	6.7
Length overall	6.24 m (20 ft 5½ in)
Height overall	2.30 m (7 ft 6½ in)
Tailplane span	2.90 m (9 ft 6¼ in)
Wheel track	2.14 m (7 ft 0¼ in)
Wheelbase	1.60 m (5 ft 3 in)
Propeller diameter: normal	1.66 m (5 ft 5¼ in)
max	1.72 m (5 ft 7¾ in)



SAI G97 Spotter (now German Aircraft Sky-MAXX) ultralight kitbuilt (Paul Jackson)

0583535

DIMENSIONS, INTERNAL:

Cabin: Length	1.16 m (3 ft 9 3/4 in)
Max width	1.08 m (3 ft 6 1/2 in)
Baggage volume	0.40 m ³ (14.1 cu ft)

AREAS:

Wings, gross	10.30 m ² (110.87 sq ft)
Tailplane	1.97 m ² (21.20 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: ultralight	283 kg (624 lb)
certified	298 kg (657 lb)
Max T-O weight: ultralight	450 kg (992 lb) ¹
ultralight alternative	530 kg (1,168 lb) ¹
certified	530 kg (1,168 lb)
Max wing loading: ultralight	43.8 kg/m ² (8.95 lb/sq ft)
ultralight alternative, certified	51.5 kg/m ² (10.54 lb/sq ft)

Max power loading: ultralight	7.56 kg/kW (12.4 lb/hp)
ultralight alternative, certified	8.90 kg/kW (14.62 lb/hp)

¹ According to local regulations

PERFORMANCE (Rotax 912 ULS):

Never-exceed speed (VNE)	129 kt (240 km/h; 149 mph)
Max level speed at S/L	119 kt (220 km/h; 137 mph)
Cruising speed at 75% power	108 kt (200 km/h; 124 mph)
Econ cruising speed	86 kt (160 km/h; 99 mph)
Stalling speed, power off:	
flaps up	38 kt (69 km/h; 43 mph)
flaps down	36 kt (67 km/h; 42 mph)
Max rate of climb at S/L	427 m (1,400 ft)/min
Service ceiling	3,505 m (11,500 ft)
T-O and landing run	50 m (165 ft)
Range with enlarged tanks	432 n miles (800 km; 497 miles)
g limits	+4/-2

GROB

BURKHART GROB LUFT- UND RAUMFAHRT E K
(ASSOCIATED WITH GROB-WERKE E K)

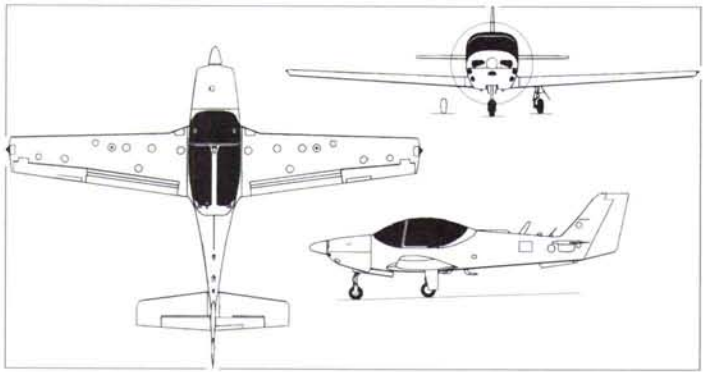
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Fax: (+49 8268) 99 81 14
e-mail: sales@grob-aerospace.de
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OWNER: Dr hc Dipl Ing Burkhardt Grob
OWNER'S REPRESENTATIVE: Dipl Ing Christian Grob
CCO: Dr Andreas Plesske
SALES MANAGER: Dipl Ing Hans Doll

Company founded 1928; began aviation activities in 1971, since when has built more than 3,500 aircraft; name changed in 1988 from Burkhardt Grob Flugzeugbau (formed 1974) to Burkhardt Grob Luft- und Raumfahrt GmbH with light and heavy sections; light section produces sailplanes, supports G 103 glider, G 109 motor glider and the G 115, G 120, G 140 and G 160 powered aircraft; heavy section supports continued operations by earlier Egrett and Strato 2C and deals with space activities in support of Weltraum-Institut Berlin. Factory covered area 28,000 m² (301,400 sq ft). G 180 twin-jet under development. G115 has been out of production since 2001, but remains available to order.

GROB G 120A

Israel Defence Force name: Snunit (Cyclone).

TYPE: Aerobatic two-seat lightplane.
PROGRAMME: First flight (D-ELHU; unannounced) 1999; development of G 115 series to meet modern airline pilot and military training requirements, having advanced features including EFIS. With retractable landing gear and 194 kW (260 hp) Textron Lycoming AEIO-540 flat-six engine.
Announced January 2001, when Lufthansa ordered three (plus four options, of which three taken up in June 2001) for its US Airline Training Center Arizona (ATCA) operation at Goodyear, near Phoenix. German LBA provisional certification achieved 22 November 2001, followed by FAA FAR Pt 23 approval on 29 January 2002 and full LBA certification on 27 February 2002. Deliveries began (with N861AF) in February 2002.
CURRENT VERSIONS: **G 120A:** Baseline version; aerobatic MTOW 1,350 kg (2,976 lb).
G 120A-I Snunit: Israel Defence Force version. Certified by LBA on 27 September 2002 and by Israeli CAA on 14 October 2002. As described.
G 120A-C: Canadian version with additional cockpit heating. Canadian Type Certificate issued 17 February 2006.
G 120A Observer: Long-range/endurance version; usable fuel capacity 378 litres (99.8 US gallons; 83.2 Imp gallons).
CUSTOMERS: Lufthansa, seven. On 19 February 2002, Cyclone Aviation, a subsidiary of Elbit Systems, contracted by Israel Defence Force/Air Force to supply pilot screening and primary training services over 10 years with company-owned and -operated fleet of up to



Grob G 120A-I aerobatic lightplane

0530193

27 G 120A-Is; first three handed over at Hatzetim AFB on 27 October 2002; however, initial Israeli order covered only 17 aircraft, last of which delivered in July 2003. One further aircraft (25th production) as company demonstrator. Total 26, including prototype, built by mid-2004.
On 24 May 2005, Kelowna Flightcraft Ltd of British Columbia, Canada, announced an order for nine G 120As, plus three options, for the Allied Wings Consortium to provide flight screening and primary flight instruction at No 3 Canadian Forces Flying Training School at Portage la Prairie, Manitoba under the contracted Flying Training and Support programme. All delivered April 2006, increasing total production to 34, plus prototype.
Description for G 120A generally as for G 115, except that below:
DESIGN FEATURES: Aerofoil Eppler E884; dihedral 2°; incidence 0°. Tailplane aerofoil NACA 64-010; fin 64-009. Airframe life 15,000 hours.
FLYING CONTROLS: Conventional and manual. Pushrod actuation for all primary surfaces. Slotted flaps electrically actuated; max deflection 60°. Servo tab and mass balance on each aileron; elevator trim tab starboard side with electric and manual actuation; rudder and elevator have mass balances, plus horn balance on rudder.
STRUCTURE: Semi-monocoque fuselage comprises a self-supporting carbon fibre-reinforced plastic shell with frame and web members. Cantilever wing of single-trapezoidal cross-section has an I-beam main spar with caps of carbon fibre rovings. Wing shell of honeycomb sandwich, except tank section of PVC foam sandwich. Interconnection of wings is via the spar stubs, bolted together with two large bolts which connect the stub spars. Each wing is attached to the fuselage by three bolts. The main spar and strong webs hold mountings for the main gear leg. An auxiliary spar closes the wing trailing-edge and carries the flaps and ailerons.
Flaps with upper and lower CFRP skins in rigid PVC foam core. Aileron structure same as flaps. Fin, integrated with fuselage, comprises main and end spar of honeycomb sandwich



Grob G 120A of Allied Wings training organisation wearing a spurious, but indicative Canadian registration

1158289

design and a carbon-reinforced full laminate shell. Structural configuration of tailplane as for wings. Tailplane attached to the fuselage by four fittings. Both elevators have top and bottom CFRP shells; structure as for ailerons. Airframe is protected from moisture and ultra-violet radiation by UP gel-coat. A white filler on the outer surface of the aircraft conducts electricity, being part of lightning protection system. White two-component polyurethane lacquer covers the filler and completes the finish. Structural service life (Aerobatic) 15,000 hours.

LANDING GEAR: Tricycle type; retractable. Mainwheels 6.00-6; nosewheel 5.00-5. Nosewheel steerable ±10°.

POWER PLANT: One 194 kW (260 hp) Textron Lycoming AEIO-540-D4D5 flat-six, driving a Hartzell HC-C3YR-1RF/F7663R three-blade, constant-speed propeller. Fuel capacity 262 litres (69.2 US gallons; 57.6 Imp gallons), of which 252 litres (66.6 US gallons; 55.4 Imp gallons) are usable. Max oil capacity 11.4 litres (3.0 US gallons; 2.5 Imp gallons).

SYSTEMS: Grob 120A-5700 landing gear hydraulic system, pressure 103 bar (1,500 lb/sq in); Grob ECS 115TA-7301 air conditioning system. Electrical system 28 V DC with 80 A alternator and Concorde RG-24-20 24 V 19 Ah battery. External power socket, port side, to rear of cockpit.

AVIONICS: Comms: Bendix/King KMA 24H-70 audio control/intercom, KY 196A VHF, KT 76C transponder.

Flight: Bendix/King KX 165A nav/com/glideslope, KN 62 DME, KLN 94 GPS, KCS 55A compass, KR 87 ADF with KI 227 indicator.

DIMENSIONS, EXTERNAL:

Wing span	10.18 m (33 ft 4¾ in)
Wing aspect ratio	7.8
Length overall	8.11 m (26 ft 7¼ in)
Height overall	2.66 m (8 ft 8¾ in)
Tailplane span	3.80 m (12 ft 5½ in)
Wheel track	2.42 m (7 ft 11¼ in)
Wheelbase	1.87 m (6 ft 1½ in)
Propeller diameter	1.98 m (6 ft 6 in)

AREAS:

Wings, gross	13.30 m² (143.2 sq ft)
Ailerons (total)	0.915 m² (9.85 sq ft)
Trailing-edge flaps (total)	1.61 m² (17.33 sq ft)
Fin	1.71 m² (18.41 sq ft)
Rudder	0.77 m² (8.33 sq ft)
Tailplane	3.04 m² (32.72 sq ft)
Elevator	0.70 m² (7.53 sq ft)

WEIGHTS AND LOADINGS (A: Aerobatic, B: Utility):

Weight empty	1,080 kg (2,381 lb)
Baggage capacity	50 kg (110 lb)
Max T-O and landing weight: A	1,440 kg (3,174 lb)
B	1,490 kg (3,284 lb)
Max zero-fuel weight	1,315 kg (2,899 lb)
Max wing loading	112.0 kg/m² (22.95 lb/sq ft)
Max power loading	7.68 kg/kW (12.62 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	235 kt (435 km/h; 270 mph)
Max level speed	172 kt (319 km/h; 198 mph)
Manoeuvre speed	165 kt (306 km/h; 190 mph)
Cruising speed at 75% power at FL50	166 kt (307 km/h; 191 mph)
Stalling speed: A	55 kt (102 km/h; 64 mph)
B	56 kt (104 km/h; 65 mph)
Service ceiling, all	5,490 m (18,000 ft)

Max rate of climb at S/L: A	390 m (1,280 ft)/min
B	366 m (1,200 ft)/min
T-O to 15 m (50 ft): A	654 m (2,146 ft)
B	707 m (2,320 ft)
Landing from 15 m (50 ft)	562 m (1,844 ft)
Range at 45% power, 30 min reserves:	
G 120A at FL80	830 n miles (1,537 km; 955 miles)
Observer at FL60	1,360 n miles (2,518 km; 1,565 miles)
Endurance at 45% power at FL20, 30 min reserves:	
Observer	11 h 40 min
g limits: G 120A Aerobatic	+6/-4
G 120A Utility, Observer	+4.4/-1.76

GROB G 140TP

TYPE: Business turboprop.
PROGRAMME: Development started early 2001. Prototype (D-ETPG), then unflown and previously unannounced, exhibited at Paris Air Show from 16 to 24 June 2001.

Design freeze completed in 2002 following incorporation of changes based on feedback from potential customers. First flight 12 December 2002; some 190 flight test hours recorded by late 2005, when certification programme was said to be 50 per cent complete.

CUSTOMERS: Potential market for 20 to 40 per year, for military and civilian markets. Production go-ahead dependent on large fleet order.

COSTS: Unpressurised version USD1.2 million (2005).

DESIGN FEATURES: Generally similar to G 115/120 series. By 2004, a ventral strake had been added to the rear fuselage.

FLYING CONTROLS: Conventional and manual. Trim tab on port elevator and each aileron; horn-balanced rudder. Slotted flaps. Dual controls (sticks) standard.

STRUCTURE: Entirely CFRP. Structural service life (aerobatic) 15,000 flight hours.

LANDING GEAR: Retractable tricycle type with trailing-link suspension on main units. Single wheel on each unit. Main legs retract inwards into wing root area, nosewheel rearwards. Hydraulic disc brakes.

POWER PLANT: One 336 kW (450 shp) Rolls-Royce 250-B17F turboprop driving an MT-Propeller MTV-5 five-blade, constant-speed (hydraulic) propeller. Integral fuel tanks in wings, combined usable capacity 520 litres (137.4 US gallons; 114.4 Imp gallons).

ACCOMMODATION: Four persons in individual seats. Separate upward-opening gullwing-type door for each seat, with circular 'porthole' window at rear of cabin on each side. Baggage door at rear of cabin on port side. Air-conditioning standard, pressurisation will be offered as an option.

AVIONICS: Bendix/King EFIS 40 two-screen EFIS as core system.

Comms: Dual Bendix/King KX 165 VHF com/MKR transceivers; KT 71 transponder; KMA 28 audio panel; ACK E-01 ELT.

Flight: Dual Bendix/King KX 165A nav; KR 87 ADF; KN 63 DME; KA 51B slaving control unit; KMT 112 magnetic azimuth transmitter.

Instrumentation: ED 461 EHSI; ED 462 EADI; Litel LCR 92 remote gyro unit; KEA 130 encoding altimeter.

DIMENSIONS, EXTERNAL:

Wing span	10.60 m (34 ft 9¼ in)
Wing aspect ratio	8.5
Length overall	8.90 m (29 ft 2½ in)
Height overall	2.80 m (9 ft 2¼ in)

AREAS:

Wings, gross	13.28 m² (142.9 sq ft)
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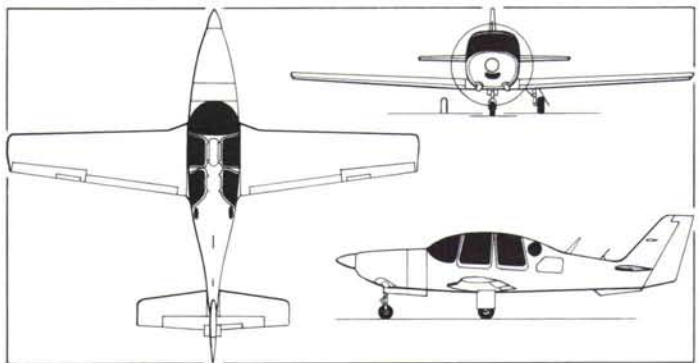


Grob G 140TP instrument panel

1043835



Prototype Grob G 140TP (Paul Jackson) 1043811



Grob G 140TP business turboprop (James Goulding) 0580557

Ailerons (total)	0.94 m ² (10.12 sq ft)
Fin	1.02 m ² (10.98 sq ft)
Rudder	0.76 m ² (8.18 sq ft)
Tailplane	2.34 m ² (25.19 sq ft)
Elevator (total, incl tab)	2.34 m ² (25.19 sq ft)
WEIGHTS AND LOADINGS (A: Aerobatic; B: Utility):	
Weight empty	1,130 kg (2,491 lb)
Max T-O and landing weight: A	1,530 kg (3,373 lb)
B	1,830 kg (4,034 lb)
Max wing loading	137.8 kg/m ² (28.22 lb/sq in)
Max power loading	5.45 kg/kW (8.95 lb/shp)
PERFORMANCE :	
Cruising speed at FL100:	
max	230 kt
long range	170 kt
Stalling speed: A	55 kt (102 km/h; 64 mph)
B	61 kt (113 km/h; 70 mph)
Max rate of climb at S/L: A	853 m (2,800 ft)/min
B	652 m (2,140 ft)/min
T-O to 15 m (50 ft): A	374 m (1,225 ft)
B	570 m (1,870 ft)
Landing from 15 m (50 ft): A	460 m (1,509 ft)
B	610 m (2,001 ft)
Range at FL100, 30 min reserves:	
with max payload	1,000 n miles (1,852 km; 1,150 miles)
with max fuel	1,100 n miles (2,037 km; 1,265 miles)
g limits: U	+4.4/-1.76
A	+6/-4

GROB G 160 RANGER

TYPE: Business turboprop.
PROGRAMME: Announced 5 May 2003; public debut of prototype (c/n 87000/D-FTGB), then unflown, at Paris Air Show 15 June 2003; first flight 29 March 2004; wing span 13.00 m (42 ft 7¾ in), area 20.48 m² (220.4 sq ft).
By late December 2004, a total of 60 flight hours had been recorded in 105 sorties that included more than 180 spins in 13 configurations, and take-offs and landings on grass and snow-covered runways. Production configuration aircraft being built in late 2005. EASA certification, originally anticipated in mid-2006, followed by FAA approval, but G 160 subsequently given lower priority in company plans.
COSTS: Approximately USD2.8 million (2004).
DESIGN FEATURES: Low-wing monoplane; winglets added by 2005; twin strakes under rear fuselage; sweptback fin; non-swept tailplane.
FLYING CONTROLS: Conventional and manual. Fowler flaps. Electric pitch trim with manual backup. Tabs in both ailerons; horn-balanced elevators with tab each side; horn-balanced rudder; inset horn on ailerons. Dual controls (yokes) standard.
STRUCTURE: CFRP/Nomex honeycomb sandwich primary structure.
LANDING GEAR: Retractable tricycle type with single wheel on each unit. Nosewheel retracts rearwards, main units retract inwards. Mainwheels 9.5x6.75-8 with hydraulic disc brakes; nosewheel 6.00-6, steerable.



Grob G 160 Ranger after addition of winglets (Paul Jackson) 1128910

POWER PLANT: One 634 kW (850 shp) Pratt & Whitney Canada PT6A-42A turboprop, flat rated at 41°C, driving a five-blade reversing Mhlbauer MTV-27-1-E-C-F-R (P)/CFR235-55 propeller. Usable fuel capacity 1,655 litres (437 US gallons; 364 Imp gallons).

ACCOMMODATION: Pilot and co-pilot or passenger in cockpit; four passengers in main cabin in club arrangement, with baggage area and lavatory in aft cabin separated by curtain; alternative layouts provide for one additional seat in rear cabin with reduced baggage space, or two additional seats without lavatory. Ambulance quick-change configuration provider for pilot and co-pilot or passenger in cockpit and single stretcher patient with two attendants in cabin. Cabin door on port side aft of wing split horizontally; crew emergency exit, forward, port; cabin emergency exit, starboard, above wing. Four cabin windows per side. Fold-out tables, individual reading lights and 110V/220V power supply for laptop computers standard. Refreshment centre optional. Accommodation is pressurised and air conditioned.

SYSTEMS: Hydraulic system for actuation of landing gear, maximum operating pressure 103.4 bar (1,500 lb/sq in). Electrical system comprises 28 V 300 A starter generator, 28 V 100 A alternator, and 24 V 40 Ah battery. 28 V DC external power receptacle standard. 110 V AC 60 Hz and/or 220 V AC 60 Hz converter for cabin power supply. Cabin pressurisation/heating supplied by engine bleed air; Honeywell cabin pressure control system (CPCS) standard. Pneumatic boot de-icing system for wing, tailplane and fin leading-edges; propeller, windscreen, pitot head, static ports and stall warning sensor electrically heated.

AVIONICS: Initial deliveries, as described, equipped with Bendix/King EFS 40 EFIS with KFC 325 flight control system. From 2007 alternative avionics fit will be Honeywell APEX integrated 'glass cockpit' comprising three-tube EFIS with 15 x 20 cm (6 x 8 in) displays for PFD, MFD and EICAS functions; Mode S transponder; and EGPWS. Options will include TCAS, radio altimeter, DME, ADF, Honeywell flight information system.

Comms: Twin KX 165A nav/com, KMA 28 intercom, KT 70 Mode S transponder, ELT.

Radar: Optional RDR 2000 weather radar.

Flight: KLN 90B GPS, KN 63 DME, KR 87 ADF, KRG 332 gyro, KNI 582 RMI, Litef LCR92 AHARS. Optional KRA 405B radar altimeter, KMH 880 TAS/TAWS, second KR 87, KT 70 and KN 63.

Instrumentation: Optional KMD 850 MFD.

DIMENSIONS, EXTERNAL:	
Wing span	14.30 m (46 ft 11 in)
Wing aspect ratio	9.6
Length overall	11.50 m (37 ft 8¾ in)
Height overall	3.40 m (11 ft 1¾ in)
Tailplane span	5.00 m (16 ft 4¾ in)
DIMENSIONS, INTERNAL:	
Cabin: Length	4.96 m (16 ft ¾ in)
Max width	1.52 m (5 ft 0 in)
Max height	1.42 m (4 ft 8 in)

AREAS:	
Wings, gross	21.20 m ² (228.2 sq ft)
Ailerons (total)	190 m ² (20.45 sq ft)
Fin	1.61 m ² (17.33 sq ft)
Rudder	1.04 m ² (11.19 sq ft)
Tailplane	3.57 m ² (38.43 sq ft)
Elevators (total)	1.39 m ² (38.43 sq ft)

WEIGHTS AND LOADINGS:	
Weight empty	2,210 kg (4,872 lb)
Max payload	720 kg (1,587 lb)
Max fuel weight	1,313 kg (2,895 lb)
Max T-O weight	3,600 kg (7,936 lb)
Max landing weight	3,300 kg (7,275 lb)
Max ramp weight	3,630 kg (8,002 lb)
Max zero-fuel weight	2,930 kg (6,459 lb)
Max wing loading	161.1 kg/m ² (33.0 lb/sq ft)
Max power loading	5.21 kg/kW (8.55 lb/shp)

PERFORMANCE:	
Max level speed at FL250	270 kt (500 km/h; 311 mph)
Max cruising speed	240 kt (444 km/h; 276 mph)
Stalling speed	61 kt (113 km/h; 71 mph)
Service ceiling	2,670 m (25,000 ft)
Max rate of climb at S/L	564 m (1,850 ft)/min
T-O to 15 m (50 ft)	736 m (2,415 ft)
Landing from 15 m (50 ft) without propeller reversal	650 m (2,133 ft)
Range, three passengers, plus pilot, cruising at FL250, 30 min reserves	1,800 n miles (3,333 km; 2,071 miles)
Range with max fuel, cruising at FL250, 30 min reserves	2,230 n miles (4,130 km; 2,566 miles)
g limits	+3.8/-1.54

GROB G 180 SP[®] UTILITY JET

TYPE: Business jet; utility twin-jet.
PROGRAMME: Project launched, but not then announced, June 2004; static testing completed between November 2004 and February 2005; public launch and debut, until then still unannounced, at Paris Air Show 13 June 2005, when prototype and cabin mockup displayed. Executet Aviation Group of Switzerland announced as sales, service and support partner at time of launch. First flight (D-IPSN) 20 July 2005. Following early testing, re-registered D-CSPN on 10 August 2005 for flights above 5,700 kg (12,566 lb). Demonstrated grass strip landing in July 2006.

Second prototype (D-CGSP) flew 29 September 2006, but was destroyed in an accident on 29 November 2006. Third prototype scheduled to fly in early 2007. EASA certification in CS 23 commuter category for single-pilot operation scheduled for third quarter 2007, followed by FAA FAR Pt 23 approval for day/night, IFR and known icing operations in fourth quarter 2007.

CUSTOMERS: Total of 65 orders held by October 2006.

COSTS: USD7.15 million (2006).

DESIGN FEATURES: Conventional low-wing configuration with unswept wing featuring small outward-canted winglets; swept fin and mildly swept tailplanes in cruciform configuration; dual downward-canted afterbody strakes. Pylon-mounted engines aft of cabin. Seven cabin windows on each side. Door on port side, immediately aft of cockpit. Wing sweepback 16° 50' at 25 per cent chord on inboard section, 9° 59' at 25 per cent chord on outboard section to wingtip. Dihedral 4°. Tailplane sweepback 20° 50' at 25 per cent chord. Fin sweepback 40° 10' at 25 per cent chord



Ill-fated Grob G 180 SPⁿ Utility Jet second prototype overflying the company's works

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FLYING CONTROLS: Conventional and manual via pushrods and bellcranks. Elevators feature a bob weight and downspring system to modulate stick-free stability and control forces. Pitch trim is via two mechanically interconnected trim tabs with one electrical actuator each for redundancy; yaw and roll trim provided by electrically driven trim tabs on rudder and ailerons. Fowler flaps actuated by central electric motor via screw jacks and flexible drives. Hydraulically actuated spoiler on upper surface of wings.

STRUCTURE: Mostly carbon fibre composites with titanium wing attachment points. Minimum certified airframe service life 28,000 flight hours.

LANDING GEAR: Hydraulically retractable tricycle type with single wheel on each unit. Main units retract inwards. Reinforced legs and oversize wheels/tyres on all units to permit operation from unpaved surfaces.

POWER PLANT: Two Williams FJ44-3A turbofans, with FADEC, each rated at 12.54 kN (2,820 lb st). Fuel in integral wing tanks with independent venting, combined capacity 2,593 litres (685 US gallons; 570 Imp gallons). Honeywell RE100 APU flight operable to 9,140 m (30,000 ft). Gravity refuelling port in each wing; single-point pressure refuelling optional.

ACCOMMODATION: Cabin interior designed by Porsche Design Studio of Austria. Standard accommodation for eight passengers in double club configuration with centre aisle. 'Plug and play' modular interior has two movable bulkheads and seats and cabinetry mounted on tracks to facilitate quick change to alternative passenger seating arrangements, mixed passenger/cargo, all-cargo or air ambulance configurations, last-mentioned accommodating two stretchers and up to four seats for medical attendants. Standard self-contained lavatory, with basin, at forward end of cabin on starboard side is also removable. Standard cabin features four foldout tables (two for each double club pair); four 110 V power outlets in the cabin, plus one each in cockpit and lavatory; eight passenger-activated LED reading lights, and up/down indirect wash lights. Large plug-type door on starboard side forward of wing, with steps that lower automatically on door opening. Emergency exit each side, adjacent to wing leading-edge. Optional cargo net attaches to seat floor tracks and cabin headliner. Main baggage compartment is separate, located on port side aft of wing and accesses via a door below engine; additional baggage compartment in nose, with access via door in starboard side.

SYSTEMS: Cabin pressurisation system maintains 2,440 m (8,000 ft) cabin environment at maximum operating altitude of FL410. Hydraulic system, pressure 206 bar (3,006 lb/sq in), operates landing gear, spoilers, braking system and nosewheel steering. Electrical system supplied by one 24 V 40 Ah and one 24 V 18 Ah lead-acid batteries and two Honeywell 28 V 400 A starter/generators. 28 V DC external power socket optional, and can be used for charging aircraft main battery. Oxygen system of 0.91 m³ (32.0 cu ft) capacity includes quick-donning demand/flow masks with detachable goggles for crew and drop-down masks above every cabin seat and in lavatory for passengers. Bleed air anti-icing for wing leading-edges and engine inlets; electric heating for cockpit windscreen on captain's side, pitot/static probes, TAT and ice detection sensors and AoA probe.

AVIONICS: Honeywell APEX integrated avionics system as standard, comprising two 381 cm (15 in) PFDs and two 254 cm (10 in) across the diagonal, centrally mounted MFDs, dual ADAHRS, multimode VHF/COM/NAV/VOR/ILS digital radios, DME, radar altimeter, Mode S transponder, TCAS II with Change 7, EGPWS/TAWS Class A, tri-frequency ELT, and 76 mm (3 in) LCD standby instrument display.

DIMENSIONS, EXTERNAL:	
Wing span over winglets	14.86 m (48 ft 9 in)
Wing aspect ratio	8.8
Length: overall	14.81 m (48 ft 7 in)
fuselage	14.18 m (46 ft 6 1/4 in)
Height overall	5.13 m (16 ft 10 in)
Tailplane span	6.48 m (21 ft 3 in)
Wheel track	3.08 m (10 ft 1 1/4 in)
Wheelbase	5.60 m (18 ft 4 1/2 in)
Passenger door: Height	1.37 m (4 ft 6 in)
Width	0.84 m (2 ft 9 in)
Rear baggage door: Height	0.465 m (1 ft 6 1/4 in)
Width	0.725 m (2 ft 4 1/2 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	5.10 m (16 ft 8 3/4 in)
Max width	1.52 m (5 ft 0 in)
Max height	1.64 m (5 ft 4 1/2 in)
Volume	11.47 m ³ (405 cu ft)
Baggage compartment volume:	
rear	0.99 m ³ (35 cu ft)
nose	0.06 m ³ (2.1 cu ft)
AREAS:	
Wings, gross	24.99 m ² (269.0 sq ft)
Tailplane	7.10 m ² (76.42 sq ft)
Fin	5.00 m ² (53.82 sq ft)



Instrument panel of Grob G 180 SPⁿ

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First (nearest) and second Grob G 180 SPⁿ prototypes

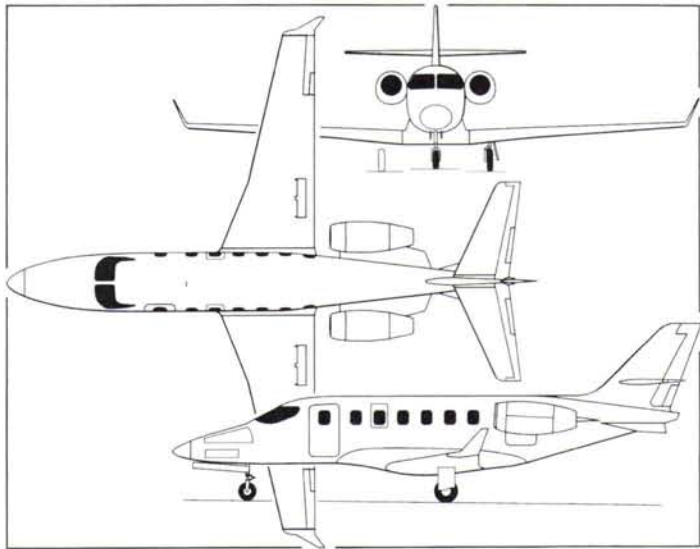
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For details of the latest updates to *Jane's All the World's Aircraft* online and to discover the additional information available exclusively to online subscribers please visit jawa.janes.com



Grob G 180 SPⁿ executive cabin layout

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Grob G 180 SPⁿ Utility Jet (Paul Jackson)

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WEIGHTS AND LOADINGS:	
Weight empty	3,510 kg (7,738 lb)
Basic operating weight (single pilot)	3,601 kg (7,939 lb)
Max baggage weight	150 kg (331 lb)
Payload: max (single pilot)	1,130 kg (2,491 lb)
with max fuel	674 kg (1,486 lb)
Max fuel weight	2,075 kg (4,575 lb)
Max T-O weight	6,300 kg (13,889 lb)
Max ramp weight	6,350 kg (13,999 lb)
Max landing weight	6,100 kg (13,448 lb)
Max zero-fuel weight	4,731 kg (10,430 lb)
Max wing loading	252.1 kg/m ² (51.63 lb/sq ft)
Max power loading	251 kg/kN (2.46 lb/lb st)
PERFORMANCE (estimated):	
Max operating Mach No.	0.70
Max operating speed: S/L to FL80	260 kt (481 km/h; 299 mph) CAS
FL80 to FL298	272 kt (504 km/h; 313 mph) CAS
Max cruising speed: at FL330	407 kt (754 km/h; 468 mph)
at FL410	402 kt (744 km/h; 463 mph)
Approach speed, landing configuration	100 kt (185 km/h; 115 mph) CAS
Stalling speed, landing configuration	77 kt (143 km/h; 87 mph)
Max rate of climb at S/L	1,329 m (4,360 ft)/min
Rate of climb at S/L, OEI	414 m (1,358 ft)/min
Time to: FL330	13 min
FL390	18 min
FL410	20 min
Max operating altitude	12,495 m (41,000 ft)
T-O balanced field length at S/L	914 m (3,000 ft)
Landing from 15 m (50 ft)	814 m (2,670 ft)
Range, with NBAA IFR reserves, 100 n mile (185 km; 115 miles) alternate:	
with max fuel	1,950 n miles (3,611 km; 2,244 miles)
pilot and six passengers	1,800 n miles (3,333 km; 2,071 miles)
g limits (design load factor)	+3, -1 to -2.4

GROB HALE G 600 and G 600 ER

TYPE: High altitude platform.

PROGRAMME: Announced 13 June 2005 following completion of concept design studies. Estimated time from formal project launch to first flight is approximately one year, with completion of flight testing and EASA/FAA certification following 11 months later. Potential roles include border/economic zone protection and coast guard duties.

CURRENT VERSIONS: **G 600:** As described.

G 600 ER: Proposed extended range version, retaining same airframe as G 600 but with more powerful engines and four additional fuel tanks in rear cabin, reducing space for mission specialist to one person.

DESIGN FEATURES: Comprises forward fuselage section, pressurised cabin, engines, horizontal tail surfaces and landing gear of the G 180 SPⁿ Utility Jet with extended rear fuselage and taller fin and new one-piece high aspect ratio wing without winglets.

STRUCTURE: Mostly carbon fibre composites with titanium wing attachment points.

LANDING GEAR: Hydraulically retractable tricycle type with single wheel on each unit. Main units retract inwards.

POWER PLANT: G 600 has two Williams FJ44-3A turbofans, with FADEC, each rated at 12.45 kN (2,800 lb st). Fuel in integral wing tanks. G 600 ER has two unspecified Williams turbofans, each rated at 16.77 kN (3,770 lb st), with four additional fuel tanks in rear cabin, each of 1,000 litres (264 US gallons; 220 Imp gallons) capacity.

ACCOMMODATION: G 600: Flight crew of two, but with single-pilot capability, plus two mission specialists in cabin. Typical cabin layout would feature two workstations for screen



Artist's impression of Grob HALE G 600

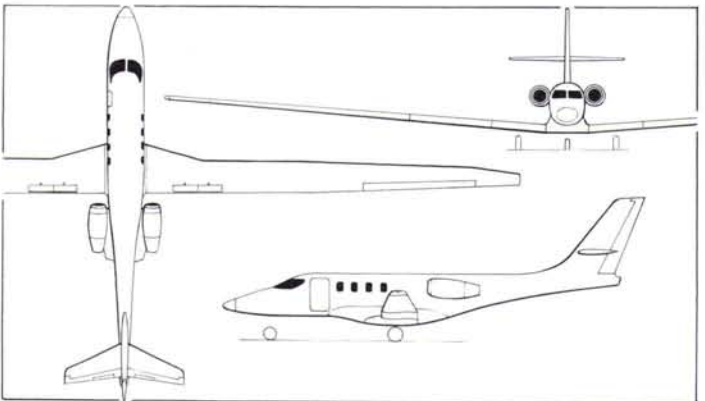
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and mission data displays with foldaway keyboards, a small bench/bunk for long endurance missions with stowage beneath, galley, lavatory and washbasin, and rack for mission equipment such as data acquisition units or computers.

G 600 ER: Flight crew of two with one mission specialist/workstation in cabin.

EQUIPMENT: Depending on the specific operation, mission equipment could include: sensors for all-weather, wide-area and spot capability including electro-optical/infrared sensors, synthetic aperture radar/moving target indicator and hyperspectral sensors for chemical and biological agent detection; line-of-sight datalink and wideband satellite datalink including satcom antenna, UHF LOS transceiver antenna, command datalink antenna and IFF transponder and antenna; self-defence systems including radar warning receiver, onboard jamming system and towed decoy launcher; unmanned systems and navigation equipment including integrated mission management computers, GPS antenna and inertial navigation system with laser gyro; and scientific payloads to measure water vapour, ozone, particles, trace-gases and radiant fluxes including milli/microjoule lidar, scatter meter inlets for gas and aerosol sampling, counter flow impactor inlet and Lyman spectrometer for condensed water, tunable diode laser for water and HNO₃, condensation nuclei counter, particle size spectrometer, integrating pyranometer, spectral radiometer, frost-point hygrometer, gas chromatograph and IR analyser for CO₂.

DIMENSIONS, EXTERNAL:	
Wing span	35.60 m (116 ft 9½ in)
Wing aspect ratio	27.0
Length overall	18.65 m (61 ft 2¼ in)
Height overall	6.50 m (21 ft 4 in)
DIMENSIONS INTERNAL (A: G 600, B: G 600 ER):	
Cabin volume: A	11.6 m ³ (410 cu ft)
B	6.2 m ³ (220 cu ft)
AREAS:	
Wing, gross: A, B	47.00 m ² (505.9 sq ft)
WEIGHTS AND LOADINGS:	
Basic operating weight, two crew: A	4,050 kg (8,929 lb)
B	4,630 kg (10,207 lb)
Max fuel: A	2,900 kg (6,393 lb)
B	6,600 kg (14,550 lb)
Max payload: A	1,200 kg (2,645 lb)
B	800 kg (1,764 lb)
Max T-O weight: A	7,750 kg (17,085 lb)
B	12,000 kg (26,455 lb)
Max wing loading: A	164.9 kg/m ² (33.77 lb/sq ft)
B	255.3 kg/m ² (52.29 lb/sq ft)
Max power loading: A	311 kg/kN (3.05 lb/lb st)
B	358 kg/kN (3.51 lb/lb st)
PERFORMANCE (at max T-O weight, ISA, except where indicated):	
Cruising speed: A, B	M0.61
Average Mach No.: A, B	0.60
Minimum loiter speed at FL650	M0.55
Max operating altitude: A	19,810 m (65,000 ft)
B	18,290 m (60,000 ft)
Time to climb: to FL600: A	1 h 0 min
B	14 h 0 min
to FL650: A	10 h 0 min
Max range: A	6,209 n miles (11,500 km; 7,145 miles)
B	11,339 n miles (21,000 km; 13,048 miles)
Loiter time at FL650: A	10 h 0 min
B	18 h 30 min
Endurance: A	17 h 20 min
B	33 h 0 min



Grob HALE G 600 high-altitude platform (James Goulding)

1133952

GYROTEC

GYROTEC

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e-mail: info@gyrotec.de
Web: www.gyrotec.de
PROPRIETOR: Michael Obermaier

Company is marketing the DF02 autogyro, a development of DF01 (F-WYGB) produced in 1980s by the late François Dedieu.

GYROTEC DF02

TYPE: Single-seat autogyro ultralight.

PROGRAMME: François Dedieu's DF01 flown at Toulouse, France, from late 1980s onwards; numerous modifications during 1990s to empennage, structure and power plant (progressively Teledyne Continental; Rotax 532; Rotax 582); Magni rotor of Italian design. Refinement complete by 2002; prototype dismantled shortly thereafter as pattern for DF02, having flown 370 hours.

Prototype DF02 (W67VN) flown 2005.

COSTS: Estimated EUR30,000 to EUR35,000 including tax (2006).

DESIGN FEATURES: Conventional enclosed autogyro with square-section metal keel mounting central fin with large rudder, plus large stabilising fins at tips of tailplane. Enclosed engine. Sportcopter rotor turning at 270 rpm; rotor section NACA 8H12, Rotor brake. Optional baggage capsule.

FLYING CONTROLS: Conventional and manual.

STRUCTURE: Central, square-section 15CDV6 welded steel keel. Pod and empennage of glass-reinforced plastic and carbon fibre sandwich. Plexiglas canopy may be omitted for fair weather flying.

LANDING GEAR: Tricycle type; fixed. Mainwheels on spring cantilever legs. Disc brakes. Optional wheel fairings.

POWER PLANT: One 52.2 kW (70 hp) Hirth 3503E water-cooled, two-stroke piston engine. Alternatively, one 58.8 kW (78.9 hp) Rotax 912 UL air-cooled flat-four. Three-blade ground-adjustable pitch propeller; option of Duc Swirl or Kiev Prop 243. Fuel capacity 60 litres (15.8 US gallons; 13.2 Imp gallons).



Maiden flight of the Gyrotec DF02

1158657

DIMENSIONS, EXTERNAL:	
Rotor diameter	7.32 m (24 ft 0 in)
WEIGHTS AND LOADINGS:	
Weight empty	175 kg (386 lb)
Max T-O weight	300 kg (661 lb)
PERFORMANCE:	
Max level speed	86 kt (160 km/h; 99 mph)
Normal cruising speed	65 kt (120 km/h; 75 mph)
Max rate of climb at S/L at 270 kg (595 lb)	300 m (984 ft)/min
T-O run	50 m (165 ft)
Landing run	10 m (35 ft)
Range	286 n miles (530 km; 329 miles)

HIGH PERFORMANCE

HIGH PERFORMANCE AIRCRAFT

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Web (2): www.kde-care.de/hpa

CEO: Klaus Götsch

HEAD OF DESIGN: Christian Majunke

Company founded by the late Heiko Teegen on 10 April 2002 as joint venture by professional aviation magazine *Pilot und Flugzeug* and local government of Mecklenburg-Vorpommern. Intention is to produce TT62 Alekto light twin-prop, for which full funding was in place by time of public launch at Berlin Air Show, 6 to 12 May 2002. Secondary purpose was restoration of Rostock-Laage airfield as centre of aviation development with initial creation of 41 jobs at High Performance plant. HPA filed for bankruptcy protection on 10 July 2006; receivers are Brinkmann & Partner.

HIGH PERFORMANCE TT62 ALEKTO and BALTIC

TYPE: Business twin-prop.

PROGRAMME: Promotion begun at ILA Berlin, 6 May 2002. Fifth-scale model flown 23 November 2002. Fuselage mockup at Aero, Friedrichshafen, April 2003; complete, but unflown, prototype (D-IXTT) at ILA, Berlin May 2004. Taxy trials began 29 December 2004; first flight, by D-IXTT on 22 February 2005, terminated after 15 minutes; no further flights made.

In late 2005, High Performance began complete redesign as a conventional twin named **Baltic** (announced 10 December 2005) with wing-mounted engines in tractor configuration, fuselage shortened by 1.54 m (5 ft 0½ in) with cabin accommodation for five passengers, and cruciform tail unit. Projected performance with 257 kW (345 hp) Centurion 4.0 Diesel engines included maximum cruising speed of 230 kt (426 km/h; 265 mph) at FL200 and 80 per cent power; and range with max fuel of 1,750 n miles (3,241 km; 2,103 miles). Model unveiled in May 2006, at which time certification and start of series production were expected in 2009, following first flight due in August 2007, but High Performance Aircraft filed for bankruptcy protection in July 2006.

CURRENT VERSIONS: Initial version as described. Projected developments include an air ambulance and aerial surveillance variant.

COSTS: EUR490,000 plus tax (2004).

DESIGN FEATURES: Design aims include speed and economy, achieved in part by internal mounting of engines for reduced frontal area and use of diesel power. Consumption 79 litres (20.9 US gallons; 17.4 Imp gallons)/h at normal cruise; 58 litres (15.3 US gallons; 12.8 Imp gallons)/h at econ cruise. Specific range, respectively, 3.84 n miles/kg and 4.80 n miles/kg.



Model of stillborn HPA TT62 Baltic

1040532

Mid-mounted wing, T tail. Two internal turbo-diesel engines connected by tubular drive-shafts to propellers mounted on upward-canted pylons at fuselage shoulders behind wing trailing-edge.

Wing section NASA LS(1)-0413 (alias GA(W)-2); dihedral 5° incidence 1°, sweepback at leading-edge 12°. Tailplane L.WK 80-120/K25, no dihedral. Fin AH 85-L-120 at root; AH 85-L-250 at tip.

FLYING CONTROLS: Conventional and manual with sidesticks. Ailerons and elevator all 30 per cent chord with aerodynamic and static balance; rudder 25 per cent chord, similar; 20 per cent chord plain flaps. Large trim tab in each aileron and in elevator; upper quarter of rudder is separate trimming rudder. Cable actuated ailerons, elevator and rudder; electrically actuated flaps; electric trim.

STRUCTURE: Carbon fibre sandwich with epoxy resin matrix throughout. Wing has two spars and four main ribs; tailplane similar; fuselage has two bulkheads and one frame; two-spar tailplane; single-spar fin.

LANDING GEAR: Retractable tricycle type, electrohydraulically actuated. Can accommodate sink rates up to 3 m; 10 ft/s. Single wheel on each trailing-link main unit; single nosewheel. Main units of aluminium 7075 and 1.4548, retracting inward into wings; nosewheel retracts forward. Mainwheels 6.50-8, nosewheel 5.0-4 (6.00-6 on prototype). Parker Cleveland brakes.

POWER PLANT: Two 228 kW (306 hp) TAE Centurion 4.0 V-8 turbocharged, FADEC-controlled Diesel engines, each driving an MT-Propeller MTV-25-1-DCF/CF175-512 five-blade constant-speed (2,300 rpm), fully feathering propeller. Cooling radiators in rear of propeller pylons. Large engine access panel each side. Fuel in wings, with gravity filler each side; total capacity 617 litres (163 US gallons; 136 Imp gallons). Baltic fuel 650 litres (175 US gallons; 146 Imp gallons).

ACCOMMODATION: Pilot and four passengers in two-one-two configuration (centre seat rearward-facing) in pressurised cabin with baggage space behind seats; differential 0.37 bar (5.5 lb/sq in); door forward of wing on port side; emergency exit for crew on lower starboard side; two cabin windows each side.

SYSTEMS: Hydraulic and electrical systems; liquid de-icing system standard. Optional air conditioning. Electrical system comprises two buses, each with separate battery. Liquid de-icing for wing, empennage and windscreen; electric propeller de-icing.

AVIONICS: Garmin G1000 suite, with two-screen EFIS. IFR standard.

DIMENSIONS, EXTERNAL:

Wing span: Alekto	11.24 m (36 ft 10½ in)
Baltic	12.60 m (41 ft 4 in)
Wing chord: at root	1.75 m (5 ft 9 in)
at tip	0.80 m (2 ft 7½ in)
Wing aspect ratio	9.0
Length overall: Alekto	11.685 m (38 ft 4 in)
Baltic	10.14 m (33 ft 3¼ in)
Fuselage: Length	10.665 m (35 ft 0 in)
Max diameter	1.55 m (5 ft 1 in)
Height without landing gear: Alekto	3.435 m (11 ft 3¼ in)
Baltic	3.54 m (11 ft 7¼ in)
Tailplane span	4.40 m (14 ft 5¼ in)
Propeller diameter	1.75 m (5 ft 9 in)
Cabin door: Max width (upper)	0.90 m (2 ft 11½ in)
Min width (lower)	0.68 m (2 ft 2¾ in)

DIMENSIONS, INTERNAL:

Cabin (between pressure bulkheads):	
Length	4.50 m (14 ft 9¼ in)
Max width (diameter)	1.40 m (4 ft 7¼ in)
Baggage compartment:	
Length	0.70 m (2 ft 3½ in)
Width	1.10 m (3 ft 7¼ in)

AREAS:

Wings, gross	15.46 m² (166.4 sq ft)
Ailerons (total)	0.67 m² (7.21 sq ft)
Flaps (total)	2.16 m² (23.25 sq ft)
Fin	2.40 m² (25.83 sq ft)

Rudder	0.60 m ² (6.46 sq ft)
Tailplane	2.66 m ² (28.63 sq ft)
Elevators (total)	1.14 m ² (12.27 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	1,780 kg (3,924 lb)
Baggage capacity	75 kg (165 lb)
Payload with max fuel	270 kg (595 lb)
Max fuel weight	500 kg (1,102 lb)
Max T-O weight	2,550 kg (5,621 lb)
Max wing loading	164.9 kg/m ² (33.78 lb/sq ft)
Max power loading	5.59 kg/kW (9.19 lb/hp)

PERFORMANCE (estimated):

Max operating speed: Alekto, Baltic	250 kt (463 km/h; 288 mph) IAS
Max cruising speed at FL200: Alekto	240 kt (444 km/h; 276 mph) TAS
Baltic	230 kt (426 km/h; 265 mph)
Normal cruising speed at FL200	230 kt (426 km/h; 265 mph) TAS
Long-range cruising speed: Alekto	190 kt (352 km/h; 219 mph) TAS
Baltic	170 kt (315 km/h; 196 mph)
Stalling speed: flaps up	80 kt (149 km/h; 92 mph) IAS
flaps down	74 kt (137 km/h; 86 mph) IAS

Service ceiling (theoretical), Baltic	9,600 m (31,500 ft)
Max certified altitude: Alekto, Baltic	7,620 m (25,000 ft)
Service ceiling, OEI: Alekto	4,420 m (14,500 ft)
Baltic	5,335 m (17,500 ft)
Max rate of climb at S/L: Alekto, Baltic	549 m (1,800 ft)/min
Max rate of climb at S/L, OEI	152 m (500 ft)/min
Time to FL200	15 min
T-O to 15 m (50 ft): Alekto	670 m (2,198 ft)
Baltic	540 m (1,770 ft)
Landing from 15 m (50 ft)	660 m (2,165 ft)
Range, 45 min reserves:	
with max payload:	
normal cruising speed	890 n miles (1,648 km; 1,024 miles)
long-range cruising speed	1,290 n miles (2,389 km; 1,484 miles)
with max fuel:	
normal cruising speed: Alekto	1,440 n miles (2,666 km; 1,657 miles)
Baltic	1,350 n miles (2,500 km; 1,553 miles)
long-range cruising speed: Alekto	1,930 n miles (3,574 km; 2,221 miles)
Baltic	1,600 n miles (2,963 km; 1,841 miles)

IKARUS

IKARUS DEUTSCHLAND
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CEO: Ing Edward Grilz

Formed in 1976 to manufacture hang gliders, Ikarus undertakes sales and distribution of the C42 and Aerostyle Breezer ultralights in Europe as well as marketing completed examples of the latter. Ikarus also produces the C22 open cockpit ultralight and several hang glider designs. Over 1,500 Ikarus aircraft and 2,500 hang gliders have been sold. Ikarus operates from a 640 m² (6,889 sq ft) factory.

IKARUS C42

TYPE: Side-by-side ultralight/kitbuilt.

PROGRAMME: Designed by Hans Gygax, and simultaneously launched in Europe (Friedrichshafen Air Show) and North America (Sun 'n' Fun) in second quarter of 1997. European deliveries began immediately; in 1997 won World Championships. On 10 May 1998 an Ikarus C42 set a new ultralight world speed record over a closed circuit of 54 n miles (100 km; 62 miles) at 90.4 kt (167.5 km/h; 104.1 mph), and on 13 May 1998 established another world record over a 270 n mile (500 km; 311 mile) closed circuit at 71.78 kt (132.93 km/h; 82.60 mph). Upgraded version, introduced April 1999, offers optional winglets of GFRP and further option of GFRP ailerons, flaps, elevators and rudder.

CURRENT VERSIONS: C42: Production version until 2003.

C42 B: Introduced 2003. Compared to earlier version, has reprofiled nose with air intake below propeller displaced rearwards. As described.

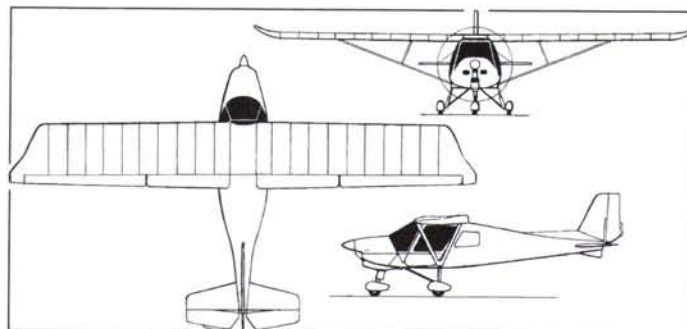
C42 Bison: Aerial towing version of C42 B launched at Aero '05 Friedrichshafen, April 2005. Rotax 914 flat-four of 84.5 kW (113.3 hp); Neuform three-blade, variable-pitch (hydraulic) propeller; ATR 500 radio and TRT 600 Mode S transponder; and internal winch; all standard and within 297 kg (654 lb) MTOW. Fuel 65 litres (17.2 US gallons; 14.3 Imp gallons). Capable of towing 750 kg (1,653 lb) sailplane in 138 m (453 ft)/min climb.

C42 Competition I/II: Kitbuilt versions with additional refinements.

CARLA-VLG: Autogyro development of C42 with wings removed and rotors added; designed by Malcolm Reid and developed by NewGen Rotorcraft of Yeovil, UK.

CUSTOMERS: First production C42 to Netherlands owner (PH-2Y5) mid-1997. Others sold in Austria, Estonia, Finland, Germany, Norway and Sweden. United Kingdom PFA type clearance, and first deliveries, early 2002. By July 2006, over 850 had been sold and production was at 80 per year; in July 2006, some 97 on British civil register.

COSTS: Ready-to-fly GBP38,479 plus VAT (2006).



Ikarus C42 B current production version (James Goulding)

1159383

DESIGN FEATURES: Strut-braced high-wing monoplane; strut-braced tail unit. Wings fold for storage.

NACA 2412 wing section.

FLYING CONTROLS: Conventional and manual. Ailerons and elevators pushrod-operated, rudder cable-operated. Plain flaps standard; electrically actuated flaps optional; flight adjustable trim tab on port elevator.

STRUCTURE: Glass fibre fuselage assembled around full-length aluminium boom; tubular aluminium wings and tail surfaces, covered with Mylar/polyester laminate (GT-foil). Aluminium wings optional. Glass fibre-reinforced epoxy resin fairings; stainless steel fittings; Makrolon transparencies. Optional carbon fibre winglets.

LANDING GEAR: Tricycle type; fixed. Oleo-pneumatic suspension and speed fairings on all three units; hydraulic brakes on main units. Full Lotus inflatable floats optional.

POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL flat-four driving a Warp Drive two-blade, carbon fibre propeller via 1:2.27 reduction gearing or 73.5 kW (98.6 hp) Rotax 912 ULS driving a GSC three-blade, ground-adjustable pitch propeller via 1:2.43 reduction gearing. Standard fuel capacity 50 litres (13.2 US gallons; 11.0 Imp gallons). Further 50 litres (13.2 US gallons; 11.0 Imp gallons) optional.

SYSTEMS: 12 V battery.

EQUIPMENT: Optional BRS 50L4 or Magnum Speed S ballistic parachute, and ELT. Spraying equipment can be fitted for agricultural operations, and a towing hook for glider- and banner-towing purposes.

DIMENSIONS, EXTERNAL:

Wing span: standard	9.45 m (31 ft 0 in)
winglet option	9.50 m (31 ft 2 in)
Length overall	6.38 m (20 ft 11 1/4 in)
Height overall	2.24 m (7 ft 4 1/4 in)



Ikarus C42 two-seat ultralight (Paul Jackson)

1159348

DIMENSIONS, INTERNAL:

Cabin max width	1.22 m (4 ft 0 in)
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AREAS:

Wings, gross	12.50 m ² (134.5 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty: Standard	268 kg (591 lb)
Competition	275 kg (606 lb)
Max T-O weight, all	472.5 kg (1,042 lb)

PERFORMANCE (Rotax 912 UL):

Max level speed	100 kt (185 km/h; 115 mph)
Cruising speed at 75% power	94 kt (175 km/h; 109 mph)
Stalling speed	35 kt (65 km/h; 41 mph)
Max rate of climb	300 m (984 ft)/min
T-O run	90 to 100 m (295 to 330 ft)
Range with standard fuel	351 n miles (650 km; 403 miles)

IMPULSE

IMPULSE AIRCRAFT GMBH

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Web: www.impulse-aircraft.de
MANAGING DIRECTOR: Philipp Steinbach

Impulse was established to produce the lightplane of the same name. This exists in Ultralight and Experimental category versions.
In 2006, Impulse released the Xtreme 3000 aerobatic version, building a new factory at Cochstedt for production.

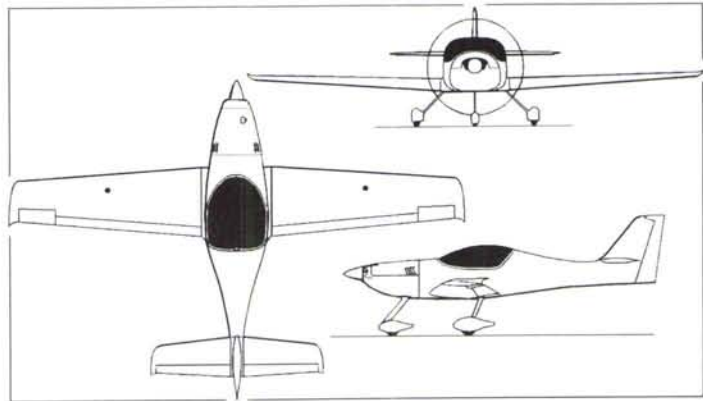
IMPULSE IMPULSE

TYPE: Two-seat lightplane; side-by-side ultralight.
PROGRAMME: Designed by Steinbach. First flight 28 July 2000. Tailwheel version first shown at Berlin in May 2002, having achieved certification on 25 April 2002. Belgian certification received 21 January 2004.
CURRENT VERSIONS: **100**: Restricted weight and power to meet 450 kg (992 lb) limit.
100TD: Tailwheel ('tail-dragger') version of 100.
130: Uprated version within US Experimental category limit. Prototype D-EKRR.
130TD: Tailwheel version introduced in 2002.
180: Higher-powered version; under development by 2002; to be certified under VLA requirements. Originally known as 360, replaced by 320.
180TD: Tailwheel version of 180; under development. D-EEZZ shown unflown at Aero '03, Friedrichshafen in April 2003; redesignated 320.
320: Higher-powered version; designation reflects engine designation.
320TD: Tailwheel version of 320.
320TDA: Aerobatic version of 320TD.
Xtreme: Turbine-powered version; prototype (D-EYKS) first flown 19 May 2005.
CUSTOMERS: Total 36 built and further six on order by May 2004, including nine in New Zealand.
COSTS: Kit: 100 EUR48,900 or 100TD EUR47,900 less engine, interior and optional factory assistance (EUR3,800 for three days; EUR14,900 for 35 days). (all 2006).
DESIGN FEATURES: Streamlined, low-wing configuration, with fuselage sharply waisted to rear of cockpit; laminar flow wing; sweptback fin with mid-mounted tailplane. Wide speed



Impulse 100 fitted with Jabiru 2200 engine (Paul Jackson)

1159349



Impulse 100 nosewheel version (Paul Jackson)

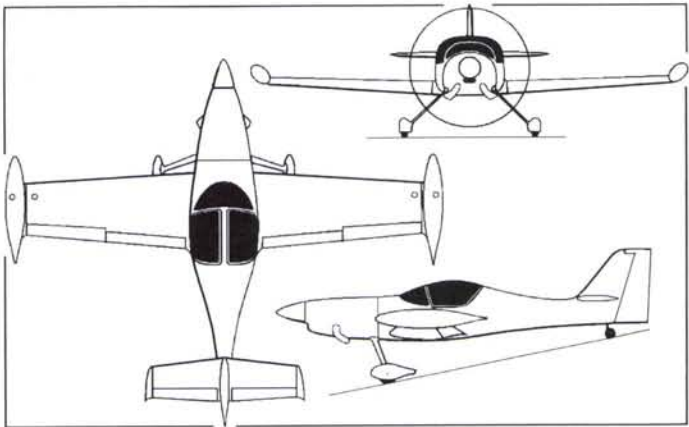
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range. Available in Experimental and Ultralight weight categories. Quoted build time 450 hours; builder assistance programme available. Wings can be removed for storage and transportation.
FLYING CONTROLS: Conventional and manual. Horn-balanced rudder; flight-adjustable trim tab in port elevator. Actuation by pushrods (elevator and ailerons) and cables (rudder). Electrically operated three-quarter-span Fowler flaps.
STRUCTURE: Fuselage of carbon-honeycomb sandwich with 1.7734.4 chromoloy engine mount. Wings of carbon-honeycomb sandwich with single main spar passing through fuselage under occupants' knees. Tail unit also of sandwich with E-glass fin, into which radio antennas are embedded. Aluminium main landing gear legs.
LANDING GEAR: Fixed, Tricycle or tailwheel (TD suffix) type with 5x5.00 mainwheels; tailwheel has solid 100 x 50 mm (4 x 2 in) tyre. Fuselage-mounted spring cantilever mainwheel legs with optional speed fairings. Foam cushion shock dampeners. Hydraulic brakes.
POWER PLANT: **100**: One piston engine: 59.7 kW (80 hp) Jabiru 2200 with two-blade, fixed-pitch propeller; or 73.5 kW (98.6 hp) Rotax 912 S flat-four, driving an MT 167R152-2M wooden three-blade, variable-pitch propeller; or 89 kW (120 hp) Jabiru 3300 flat-six with MT-Propeller two-blade, constant-speed propeller. Fuel in wing tanks, capacity 110 litres (29.1 US gallons; 24.2 Imp gallons). Option to fit 89.5 kW (120 hp) Jabiru 3300.
130 and 130TD: Options of 95 kW (128 hp) Limbach L2400ET flat-four and 118 kW (158 hp) LOM M332 in-line four. Fuel capacity 160 litres (42.3 US gallons; 35.2 Imp gallons).
320, 320TD and 320TDA: One 119 kW (160 hp) Lycoming IO-320 or one 134 kW (180 hp) Textron Lycoming IO-360-M1A driving an MT-Propeller MTV-12-B three-blade, variable-pitch propeller. Fuel capacity 200 litres (52.8 US gallons; 44.0 Imp gallons) in two integral wingtanks.
Xtreme: One 313 kW (420 shp) Rolls-Royce 250-B15 or -B17 driving an MT five-blade constant-speed propeller.
Fuel capacity 390 litres (103 US gallons; 85.8 Imp gallons) in two 85 litre (22.5 US gallon; 18.7 Imp gallon) wing tanks, two 85 litre (22.5 US gallon; 18.7 Imp gallon) wingtip tanks and one 50 litre (13.2 US gallon; 11.0 Imp gallon) header tank (latter fuel unusable).
Optional power plants include BMW motorcycle engine and Thielert TAE 125 turbo-diesel.
ACCOMMODATION: Two persons, side by side, beneath single-piece hood; baggage space behind seats.
SYSTEMS: 12 V starter and generator.
EQUIPMENT: BRS parachute system.
DIMENSIONS, EXTERNAL (UL: Ultralight, E: Experimental):
Wing span: all except 320TDA, Xtreme 8.74 m (28 ft 8 in)
320TDA 7.32 m (24 ft 0 in)
Xtreme 7.42 m (24 ft 4 1/4 in)
Wing aspect ratio 7.8
Length overall: 100 6.30 m (20 ft 8 in)
130, 130TD 6.10 m (20 ft 0 1/4 in)
320, 320TD, 320TDA 6.20 m (20 ft 4 in)
Xtreme 6.58 m (21 ft 7 1/4 in)
Height overall: 320 1.70 m (5 ft 7 in)
320TD, 320TDA, Xtreme 1.49 m (4 ft 10 3/4 in)
Tailplane span: all except 320TDA, Xtreme 3.29 m (10 ft 9 1/2 in)
320TDA 3.05 m (10 ft 0 in)
Xtreme 2.77 m (9 ft 1 in)



Impulse Xtreme 3000 prototype

1159277



Impulse Xtreme general arrangement (Paul Jackson)

1159384

Wheel track: 100, 130, 320TD, 320TDA	2.10 m (6 ft 10¾ in)
320	1.46 m (4 ft 9½ in)
Xtreme	2.29 m (7 ft 6 in)
Wheelbase: 320	2.20 m (7 ft 2½ in)
320TD, 320TDA	4.20 m (13 ft 9½ in)
Xtreme	3.94 m (12 ft 11¼ in)
DIMENSIONS, INTERNAL:	
Cockpit max width	1.18 m (3 ft 10½ in)
AREAS:	
Wings, gross: all except 320TDA, Xtreme	9.82 m² (105.7 sq ft)
320TDA, Xtreme	8.56 m² (92.1 sq ft)
WEIGHTS AND LOADINGS (100 with Rotax, 130 with LOM engine):	
Weight empty: 100	260 kg (573 lb)
130	320 kg (705 lb)
130TD	350 kg (772 lb)
320, 320TD, 320TDA	420 kg (925 lb)
Xtreme	422 kg (930 lb)
Baggage capacity: 100	20 kg (44 lb)
130	50 kg (110 lb)
320, 320TD, 320TDA	59 kg (130 lb)
Xtreme	60 kg (132 lb)
Max T-O weight: 100	472.5 kg (1,042 lb)
130, 130TD	720 kg (1,587 lb)
320, 320TD, 320TDA	750 kg (1,655 lb)
Xtreme	952 kg (2,100 lb)
Max wing loading:	
130, 130TD	73.3 kg/m² (15.01 lb/sq ft)
320TDA	87.7 kg/m² (17.97 lb/sq ft)
320, 320TD	76.4 kg/m² (15.66 lb/sq ft)
Xtreme	111.3 kg/m² (22.80 lb/sq ft)
Max power loading:	
130	6.11 kg/kW (10.04 lb/hp)
320, 320TD, 320TDA	6.30 kg/kW (10.34 lb/hp)
Xtreme	3.04 kg/kW (5.00 lb/shp)
PERFORMANCE (100, 130 as above):	
Never-exceed speed (VNE):	

100	145 kt (270 km/h; 167 mph)
130, 130TD	226 kt (420 km/h; 261 mph)
Max level speed: 320, 320TD	178 kt (330 km/h; 205 mph)
320TDA	180 kt (333 km/h; 207 mph)
Xtreme	270 kt (500 km/h; 311 mph)
Max cruising speed at 75% power:	
100	130 kt (240 km/h; 149 mph)
130, 320, 320TD	162 kt (300 km/h; 186 mph)
130TD	170 kt (315 km/h; 196 mph)
320TDA	165 kt (306 km/h; 190 mph)
Xtreme	230 kt (426 km/h; 265 mph)
Stalling speed, flaps up: 100	35 kt (65 km/h; 41 mph)
130	41 kt (75 km/h; 47 mph)
130TD	44 kt (82 km/h; 51 mph)
320, 320TD	43 kt (80 km/h; 50 mph)
320 TDA	49 kt (91 km/h; 57 mph)
Xtreme	55 kt (102 km/h; 64 mph)
Max rate of climb at S/L: 320, 320TD, 320TDA	732 m (2,400 ft)/min
Xtreme	2,438 m (8,000 ft)/min
Service ceiling: all	6,095 m (20,000 ft)
T-O run: 100	60 m (197 ft)
130, 130TD	100 m (330 ft)
180	120 m (395 ft)
T-O to 15 m (50 ft): 100TD, 130	200 m (656 ft)
320, 320TD	158 m (520 ft)
320TDA	240 m (787 ft)
Xtreme	91 m (300 ft)
Landing from 15 m (50 ft): 100, 100TD, 130	210 m (690 ft)
320, 320TD	259 m (850 ft)
320TDA	400 m (1,312 ft)
Xtreme	122 m (400 ft)
Range: 100	647 n miles (1,200 km; 745 miles)
130, with auxiliary tank	3,509 n miles (6,500 km; 4,038 miles)
320, 320TD, 320TDA	900 n miles (1,666 km; 1,035 miles)
Xtreme	950 n miles (1,759 km; 1,093 miles)

M+D

M+D FLUGZEUGBAU GMBH

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Web: www.md-flugzeugbau.de
DIRECTOR: Tim Markwald

M+D formed in 1995 as a support organisation for sailplanes, with services including repair, overhaul, modification and sales. Company occupies a 2,200 m² (23,675 sq ft) plant close to Bohlenerbergfeld gliding airfield.
In late 2005, M+D began production of the Samburo motor glider which had previously been discontinued by Aircraft Philipp, although originating in a design by Alpha Werke of Austria.

M+D AVO 68-R SAMBURO

TYPE: Motor glider.
PROGRAMME: Original AVo 68-S built in 1970s. Named for Kenyan tribe. New AVo 68-R variant, using converted AVo 68-S D-KFGN (c/n 024) as prototype, developed by Nitsche Flugzeugbau and first flew March 1995, retaining original landing gear of single nosewheel. Second prototype converted from AVo 68-S D-KALO (029), incorporating new twin leg landing gear design. First production AVo 68-R D-KSAM, with turbocharged and intercooled Rotax 914 engine, lengthened and widened fuselage and new canopy design, exhibited unflown at Aero '99 at Friedrichshafen in April 1999; first flight shortly thereafter. Programme transferred to Aircraft Philipp in 2001, but discontinued almost immediately thereafter. Production restarted by M+D in 2005.
CURRENT VERSIONS: **AVo 68-R100:** With Rotax 912 FS engine.
AVo 68-R115: With Rotax 914 engine.
CUSTOMERS: Earlier AVo 68v and AVo 68-S production totalled 29. Eight new aircraft and at least five conversions completed up to 2001.
DESIGN FEATURES: Mid-wing configuration with wingtip fences and moderate sweepback on all leading-edges. Improvements over AVo 68-S include more powerful engine, wider cockpit, glider towing capability, conventional aeroplane landing gear and modernised avionics. Wing folding optional. Maintenance checks at 100 hour intervals.
FLYING CONTROLS: Conventional and manual. Adjustable tab on starboard elevator and plain (door-type) spoilers in upper wings. No flaps.
STRUCTURE: Steel fuselage frame covered with glass fibre. Wings of wood with glass fibre covering to two-thirds chord on inboard panels and whole of outboard fixed surface; polyester covering on remaining wing surface, ailerons and elevator and rudder.

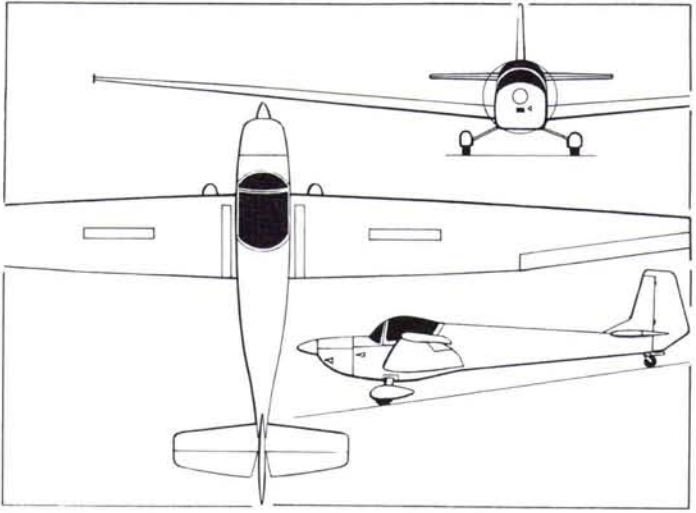


First production AVo 68-R Samburo (Paul Jackson)

0110627

LANDING GEAR: Non-retractable tailwheel type with composites cantilever main legs and castoring tailwheel which unlocks on application of differential hydraulic braking; speed fairings standard. Monowheel configuration with outrigger under each wing optional.
POWER PLANT: One Rotax 912 FS3/FS4 rated at 73.5 kW (98.6 hp) for take-off and 69.8 kW (93.6 hp) maximum continuous, or optional Rotax 914 F3 rated at 84.6 kW (113.4 hp) for take-off and 73.5 kW (98.6 hp) maximum continuous, both with Hoffmann HO-V352F-S2 constant-speed feathering propeller. Throttle connected to variable pitch control in one combined lever to replicate fixed-pitch propeller motor gliding handling. Fuel contained in two wing tanks plus header tank. Total capacity 80 litres (21.1 US gallons; 17.6 Imp gallons), of which 79.5 litres (21.0 US gallons; 17.5 Imp gallons) are usable.
ACCOMMODATION: Two persons, side by side under rearward-sliding canopy. Baggage compartment behind seats.
AVIONICS: *Comms:* Optional equipment includes Filsler ATR 720A, Becker AR 4201 or Dittel FSG 71M or FSG 90 coms; Honeywell KY 125 nav/com; Honeywell KT 76A or Becker ATC 2000 transponder; and ACK Technologies ELT.
Instrumentation: Winter 6 FMS ASI, 4 FGH 10 altimeter, 5 StV variometer, compass, ammeter, oil temperature and pressure gauges and CHT gauge all standard. Optional instruments include second altimeter, RC Allen or SEENA 703 artificial horizon, gyrocompass and Elba electronic fuel indicator.
EQUIPMENT: Standard equipment includes ergonomic seats with back supports, four-point seat harnesses, carburettor heat, cockpit heating and ventilation, rudder-mounted antenna and two-colour external paint scheme. Options include hydraulic brake for single-wheel landing gear, glider-towing kit, shift lock for airbrakes, landing and position lights and additional external generator.
DIMENSIONS, EXTERNAL:

Wing span	16.68 m (54 ft 8¾ in)
Wing aspect ratio	13.4
Width, wings folded (option)	10.00 m (32 ft 9¼ in)
Length overall	8.05 m (26 ft 5 in)
Height overall	1.86 m (6 ft 1¼ in)
Tailplane span	3.44 m (11 ft 3½ in)
Wheel track	1.10 m (3 ft 7¼ in)



M+D AVo 68-R Samburo motor glider (James Goulding)

1159386

AREAS:	
Wings, gross	20.70 m ² (222.81 sq ft)
WEIGHTS AND LOADINGS (A: Rotax 912 FS3/FS4; B: Rotax 914 F3):	
Weight empty	550 kg (1,212 lb)
Max T-O weight	700 kg (1,543 lb)
Max wing loading	33.8 kg/m ² (6.93 lb/sq ft)
Max power loading: A	9.52 kg/kW (15.65 lb/hp)
B	8.27 kg/kW (13.59 lb/hp)
PERFORMANCE, POWERED:	
Never-exceed speed (VNE)	116 kt (215 km/h; 133 mph)
Cruising speed, 60.4 kW (81 hp) engine at 75% power	97 kt (180 km/h; 112 mph)

MECKLENBURGER

MECKLENBURGER ULTRALEICHT (FLUGZEUGBAU CHRISTIAN ENGELN)

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e-mail: info@meck-ul.de
Web (1): www.meck-ul.de
Web (2): www.peak-aerospace.com
CEO: Christian Engelen

Mecklenburger was established by Herr Engelen to develop ultralight versions of significant Second World War aircraft, principally fighters. A scale Messerschmitt 109 has been produced in composites, based on an original replica devised by Tassilo Bek. In 2006, the company entered into partnership with Peak Aerospace GmbH.

MECKLENBURGER Me-109

TYPE: Single-seat ultralight kitbuilt.
PROGRAMME: Mecklenburger launched production of current version in late 2003, following construction of some eight of earlier (Bek) series, including c/n 007 with Rotax 912 UL flat-four of 59.6 kW (79.9 hp). By April 2004, the prototype of the new series was 58 per cent complete, aircraft '9' (c/n 9) exhibited incomplete at Berlin, May 2004; third aircraft (D-MYME) shown complete, but unflown, at ILA, Berlin, May 2006.
CURRENT VERSIONS: **Ultralight:** MTOW limited to 300 kg (661 lb).
Experimental: Short-span, increased weight version.
COSTS: *Ultralight:* Basic kit (minus engine and instruments) EUR24,700; flyaway EUR44,950 (with Rotax 582) (all including tax, 2006).
DESIGN FEATURES: Approximately three-quarters scale replica of Messerschmitt Bf 109. Low, tapered wing; strut-braced tailplane. Quoted build time 600 hours.
FLYING CONTROLS: Conventional and manual. Horn-balanced rudder; plain ailerons. No flaps on Ultralight version. Experimental version has three-position (0, 15, 30°) flaps. Trim tab in starboard elevator.
STRUCTURE: Predominantly of glass and carbon fibre, with fabric-covered wooden control surfaces. One-piece wing has 11 composite ribs each side and is covered with plywood (80 per cent) and fabric.



Third production Mecklenburger Me-109 (Paul Jackson)

1159350

MK

MK HELICOPTER GMBH

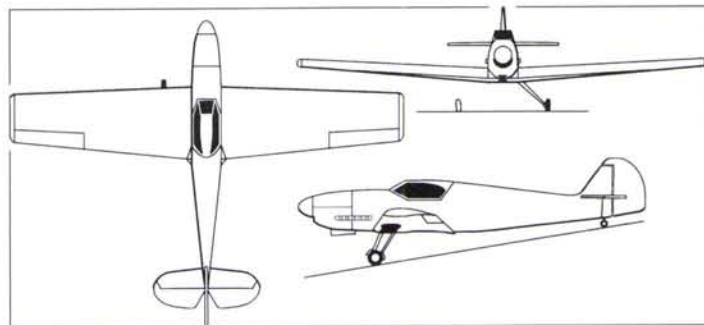
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e-mail: info@mk-helicopter.de
Web: www.mk-helicopter.de
TECHNICAL MANAGER: Uwe Mathes
PROJECT ENGINEER: Thys Pieterse
FACTORY MANAGER: Jens Klöver

The MK II light helicopter was developed into the MK3, which received its public debut at Aero '05, Friedrichshafen, in April 2005.

MK HELICOPTER MK3

TYPE: Three-seat helicopter.
PROGRAMME: Design (initially as Ultralight Mk 2 and later MK Helicopter Mk II) started 1995. Construction of prototype scheduled to begin in December 2001; first flight expected September 2003; construction of first production helicopter anticipated in January 2003; EASA 27 certification process began in March 2001 and completion expected in June 2003. Eventually, advanced engineering mockup was exhibited at Friedrichshafen in April 2005, when MK announced plans to fly two prototypes in 2006. However, these plans delayed by lack of funding, although promotion continued at ILA, Berlin, May 2006. Production will be in USA/Canada or Asia/Pacific.
CURRENT VERSIONS: **MK30 (previously MK3-A):** Avgas-fuelled Textron Lycoming piston engine. Prototype and available to order.

Stalling speed	30 kt (56 km/h; 35 mph)
Max rate of climb at S/L: A	342 m (1,122 ft)/min
B	360 m (1,181 ft)/min
T-O run: A	118 m (390 ft)
B	95 m (315 ft)
T-O to 15 m (50 ft): A	183 m (600 ft)
B	165 m (545 ft)
Max range	540 n miles (1,000 km; 621 miles)
PERFORMANCE, UNPOWERED:	
Best glide ratio, at 51 kt (94 km/h; 59 mph)	25
Min rate of sink	1.15 m (3.77 ft)/s



Mecklenburger Me-109 general arrangement (Paul Jackson)

1159387

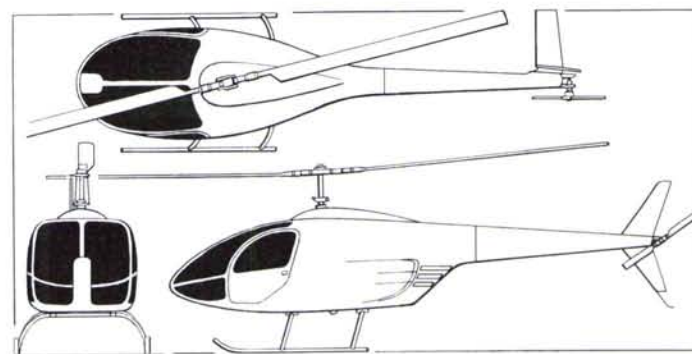
LANDING GEAR: Tailwheel type with manually retractable (outwards) mainwheels. Mainwheel doors of wood. Tailwheel 2.00-5; mainwheels 4.00-4 with cable brakes.	
POWER PLANT: One piston engine. Options include 48.0 kW (64.4 hp) Rotax 582 and 59.6 kW (79.9 hp) Rotax 912 for Ultralight and 59.7 kW (80 hp) Subaru EA-71 for Experimental category; also under consideration is the 46.2 kW (62 hp) Suzuki G10 three-cylinder four-stroke engine. Fuel capacity 55 litres (14.5 US gallons; 12.1 Imp gallons) in single tank located between pilot's feet.	
EQUIPMENT: Ballistic parachute option on German-registered aircraft.	
DIMENSIONS, EXTERNAL (UL: Ultralight, EX: Experimental):	
Wing span: UL	8.10 m (26 ft 7 in)
EX	6.70 m (21 ft 11 1/4 in)
Length overall: UL, EX	6.70 m (21 ft 11 1/4 in)
Height: propeller turning	2.10 m (6 ft 10 3/4 in)
to fin tip	1.17 m (3 ft 10 in)
AREAS:	
Wings, gross: UL	10.10 m ² (108.7 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty: UL	190 kg (441 lb)
EX	280 kg (617 lb)
Max T-O weight: UL	322 kg (661 lb)
EX	420 kg (926 lb)
PERFORMANCE (UL with Rotax 582, EX with Subaru):	
Max level speed: UL	119 kt (220 km/h; 137 mph)
UL, Rotax	130 kt (240 km/h; 149 mph)
EX	145 kt (270 km/h; 167 mph)
Cruising speed at 65% power:	
UL	97 kt (180 km/h; 112 mph)
EX	103 kt (190 km/h; 118 mph)
Stalling speed: UL	32 kt (59 km/h; 37 mph)
EX	36 kt (65 km/h; 41 mph)
Service ceiling	3,000 m (9,840 ft)
T-O run	100 m (328 ft)
Range	270 n miles (500 km; 310 miles)
g limits: UL	+4/-2
EX	+6/-4

MK3 (previously MK3-J): Jet A-1-fuelled Diesel engine. Envisaged main production version.

MK5: Five-seat version powered by Textron Lycoming TIO-540 (MK50) and not-yet-determined Diesel equivalent (MK5).

COSTS: Target USD280,000 (2003).

DESIGN FEATURES: Three-blade semi-articulated main rotor with hydraulically boosted cyclic control (two-blade in original design); two-blade tail rotor on port side. Main rotor blade section Eppler E361; tail rotor blade section NACA 81012. Engine drives single-stage bevel-gear 1:2.5 reduction transmission with belt drive for main rotor; 90° bevel gear drive for tail rotor. Sweptback dorsal and ventral fins.



MK3 helicopter (James Goulding)

1159388



MK Helicopter MK3/MK30 (Paul Jackson) 1159351

STRUCTURE: Tubular main frame with aluminium sheet box structure; Nomex/carbon fibre sandwich fuselage. Main blades comprise glass/carbon-reinforced plastic (GRP) skin over Rohacell foam core with lead inlay. Aluminium tail rotor.

LANDING GEAR: Skid type.

POWER PLANT: One 196 kW (260 hp) Textron Lycoming IO-540-AE1A5 flat six in MK30 prototype. Production aircraft (MK3) generally with Thielert Centurion 4.0 of 195 kW (261 hp). Fuel contained in two tanks above engine, combined capacity 180 litres (47.6 US gallons; 39.6 Imp gallons).

REMOS

REMOS AIRCRAFT GMBH

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Web(1): www.remos.com
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PRODUCTION PLANT:
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Remos company formed in 1983, and Remos Aircraft in 1990; currently markets the G-3 Mirage and announced the G-4 at Friedrichshafen in April 2001, although no further progress has been made with the latter. Non-aviation activities of the parent company involve production of automotive components, including an enclosed road trailer for the Mirage.

In 2003, Remos appointed RLS Air of Bloomfield, Indiana as its US distributor, leading to LSA approval in 2006.

REMOS G-3 MIRAGE

TYPE: Side-by-side ultralight/kitbuilt.

PROGRAMME: Prototype (D-MRAE) exhibited at Friedrichshafen Aero '97, April 1997. First flight 20 September 1997. First prize in 1998 German two-seat ultralight championships. Production version, shown in April 1999, featured rudder horn balance and minor changes to ailerons and elevator. **Mirage S**, certified 16 August 1999 with 74.6 kW (100 hp) Rotax 912 ULS, has 113 kt (210 km/h; 130 mph) cruising speed. In June 2000, D-MPCJ shown (then unflown) at ILA, Berlin, with 53.7 kW (72 hp) Swiss Auto SAB 430 turbocharged, two-cylinder, four-stroke motorear engine, which installation weighs 30 kg (66 lb) less than Rotax. **Mirage RS**, with redesigned rudder and landing gear, plus addition of roof window and more extensive instrumentation, introduced at Aero '01, April 2001.

At Aero '03, April 2003, Remos unveiled the **Mirage RS/L (Leicht)**, which features more than 100 weight-saving modifications totalling 10 kg (22 lb), the main change being to a Jabiru 2200A engine. Prototype D-MPLK (c/n 137) flown shortly after exhibition and all subsequent aircraft to this standard.

In 2003, Remos announced **Mirage ARF** (almost-ready-to-fly) kit. **G-3/600** development of Mirage marketed from early 2004 to take advantage of LTF-2003 increased max T-O weight limit of 472.5 kg (1,042 lb) for German (and French) ultralights; prototype displayed at Sun 'n' Fun, April 2004, and had flown by end of that month; '600' indicates tested to 6 g load at 600 kg (1,322 lb). Special LSA approval achieved March 2006.

G-3 RaLi: Version marketed by Jordan Aerospace Industries and announced at Dubai Air Show, 2004. However, by 2006 this was no longer being promoted.



Remos G-3/600 registered in US as Light Sport Aircraft (Paul Jackson) 1159352

ACCOMMODATION: Pilot and two passengers, or pilot and one student with dual controls. Cabin heated and ventilated. Forward-hinged door each side.

SYSTEMS: 24 V battery for electrical system.

AVIONICS: 'Glass cockpit'.

DIMENSIONS, EXTERNAL:

Main rotor diameter	9.00 m (29 ft 6 1/4 in)
Tail rotor diameter	1.56 m (5 ft 1 1/2 in)
Main rotor blade chord	0.24 m (9 1/2 in)
Tail rotor blade chord	0.13 m (5 in)
Length: overall, rotors turning	10.60 m (34 ft 9 in)
Fuselage: Length	7.70 m (25 ft 3 in)
Max width	1.70 m (5 ft 7 in)
Height overall	2.92 m (9 ft 7 1/4 in)
Skid track	2.10 m (6 ft 10 3/4 in)

AREAS:

Main rotor disc	63.60 m ² (684.6 sq ft)
Tail rotor disc	1.91 m ² (20.56 sq ft)

WEIGHTS AND LOADINGS (MK3 and MK30, where different):

Weight empty, equipped: MK3	704 kg (1,552 lb)
MK30	680 kg (1,499 lb)
Max T-O weight	1,136 kg (2,504 lb)
Max disc loading	17.9 kg/m ² (3.66 lb/sq ft)

PERFORMANCE (estimated, MK3 and MK30):

Never-exceed speed (VNE)	130 kt (241 km/h; 149 mph)
Max cruising speed at S/L	120 kt (222 km/h; 138 mph)
Max rate of climb at S/L	274 m (900 ft)/min
Service ceiling	4,570 m (15,000 ft)
Hovering ceiling: IGE	2,743 m (9,000 ft)
OGE	1,371 m (4,500 ft)
Max range	351 n miles (650 km; 403 miles)

CUSTOMERS: Over 175 sold by mid-2006. Exports include Argentine police and undisclosed military agency in Romania; several to US from 2002 onwards. Other sales in Netherlands, New Zealand, Poland, Switzerland and Thailand. Total of 11 sold in Germany in 2004.

COSTS: G-3/600 EUR67,999, excluding tax (2006). Upgrade to Rotax 912S extra EUR2,700.

DESIGN FEATURES: Meets FAR Pt 23. Intended for recreational and instructional use. Waisted rear fuselage, sweptback fin and braced wing with tapered outer panels. Wings fold for transportation and storage.

FLYING CONTROLS: Conventional and manual. Single-piece elevator with flight-adjustable inset tab. Horn-balanced rudder, ailerons and elevator. No rudder tab. Horn-balanced control surfaces on production version. Electrically operated flaps and trim.

STRUCTURE: Composites fuselage; wings of sandwich composites; leading edges and tips composites, remainder fabric-covered; all tail surfaces composites. Tail bumper, GFRP ailerons and flaps. Composites parts produced in Poland; metal parts in Germany.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring cantilever main gear with hydraulic drum brakes and integral speed fairings; rubber-in-compression nosewheel leg with speed fairing. Mainwheels 4.00-6; nosewheel 4.00-6.

POWER PLANT: Baseline model has one 59.6 kW (79.9 hp) Rotax 912 UL four-stroke engine, driving a GT-2/169.5 two-blade wooden propeller. Optionally, a certified 73.5 kW (98.6 hp) Rotax 912 ULS or /S2 can be fitted. **Mirage RS/L** has one 59.7 kW (80 hp) Jabiru 2200A flat-four driving a GT-2/166/VSR-FW101STRC two-blade, wood-and-composites, fixed-pitch propeller. Fuel capacity 70 litres (18.5 US gallons; 15.4 Imp gallons); can be increased to 80 litres (21.1 US gallons; 17.6 Imp gallons).

AVIONICS: To customer's specification.

EQUIPMENT: Junkers or BRS ballistic parachute.

DIMENSIONS, EXTERNAL:

Wing span	9.80 m (32 ft 1 3/4 in)
Length	6.47 m (21 ft 2 3/4 in)
Height overall	1.70 m (5 ft 7 in)

DIMENSIONS, INTERNAL:

Cockpit max width	1.17 m (3 ft 10 in)
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AREAS:

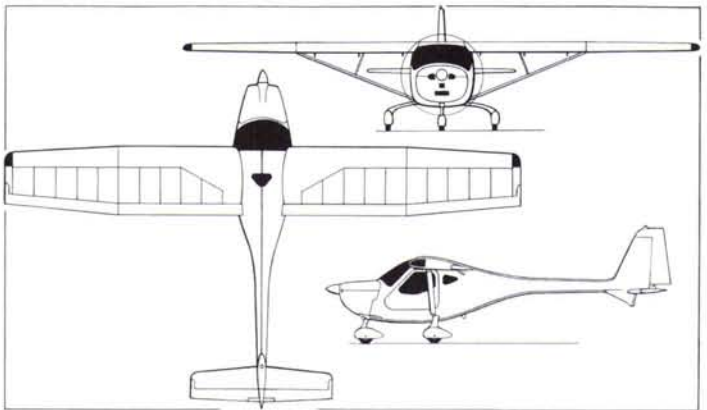
Wings, gross	12.04 m ² (129.6 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	284 kg (626 lb)
Max T-O weight: BFU-95	450 kg (992 lb)
LTF-2003	472.5 kg (1,041 lb)
US LSA	558 kg (1,232 lb)

PERFORMANCE, POWERED (A: Rotax 912UL, B: Rotax 912 ULS):

Never-exceed speed (VNE)	121 kt (225 km/h; 139 mph)
Max level speed	105 kt (195 km/h; 121 mph)
Normal cruising speed: A	105 kt (195 km/h; 121 mph)
B	111 kt (205 km/h; 127 mph)



Remos G-3 Mirage (James Goulding) 1159389

Stalling speed	34 kt (63 km/h; 40 mph)
Max rate of climb at S/L: A	390 m (1,280 ft)/min
B	348 m (1,141 ft)/min
T-O run	60 m (197 ft)
T-O to 15 m (50 ft): A	150 m (495 ft)
B	180 m (590 ft)
Landing from 15 m (50 ft): both	200 m (660 ft)

Range	more than 486 n miles (900 km; 559 miles)
Endurance	6 h
g limits	+4/-2
PERFORMANCE, UNPOWERED:	
Best glide ratio	17
Min rate of sink	1.80 m (5.91 ft)/s

RMT

RMT AVIATION GMBH & CO KG

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 Fax: (+49 354) 718 08 07
 e-mail: info@rmtaviation.com
 Web: www.rmtaviation.com
 MANAGING DIRECTOR: André von Schoenbeck

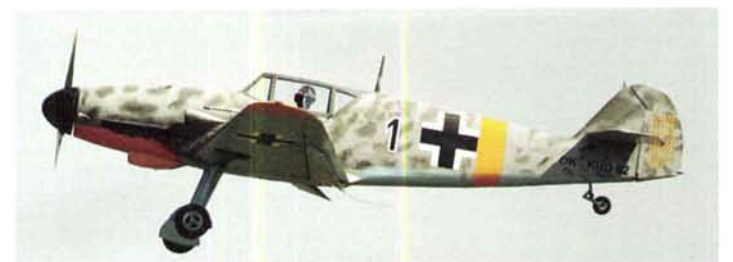
RMT Aviation markets the Bateleur kit, designed by its managing director, having moved to Germany from South Africa in 2001. In 2002 RMT was building a 2,500 m² (26,900 sq ft) plant in South Africa. A European facility will be located at Bremgarten aerodrome, Germany, while plans for a North American plant have been discussed; however, no evidence of production by mid-2006.

ROLAND

ROLAND AIRCRAFT

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 PRESIDENT: Roland Hauke

Roland is German distributor of Zenith and AMD ultralights and lightplanes. The company's latest venture is a scale replica of the Messerschmitt Bf 109 Second World War fighter engineered in Czech Republic.



Roland Bf 109G-2 ultralight kitbuilt

1159278

ROLAND Bf 109G-2

TYPE: Tandem-seat sportplane/kitbuilt.
 PROGRAMME: Engineered in Czech Republic by Petr and Thomas Podesva, also responsible for Trener Baby and Let-Mont series of aircraft. Partly complete prototype displayed at Aero '05, Friedrichshafen, April 2005. Maiden flight performed early 2006 by prototype (OK-KUD 02). Initial marketing in Experimental class; Ultralight to follow, with kit option.
 DESIGN FEATURES: Replica of Dipl Ing Willy Messerschmitt's Bayerische Flugzeugwerke Bf 109G-2 to 82 per cent scale.
 FLYING CONTROLS: Conventional and manual; horn-balanced rudder and elevators, plain ailerons. Optional split flaps.
 STRUCTURE: Generally of metal. Welded steel tube cockpit with aluminium skin. Composites wingtips, spinner and engine cowlings. Fabric-covered rudder and elevators.

LANDING GEAR: Tailwheel type; mainwheels, size 400x100, retract outwards. Steel tube legs with oleo shock-absorbers. Fully castoring tailwheel.
 POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS flat-four driving a Kaspar ground-adjustable, three-blade propeller.
 DIMENSIONS, EXTERNAL:
 Wing span 8.14 m (26 ft 8½ in)
 Length overall 7.30 m (23 ft 11½ in)
 Height overall 2.30 m (7 ft 6½ in)
 PERFORMANCE:
 Never-exceed speed (VNE) 162 kt (300 km/h; 186 mph)
 Normal cruising speed 130 kt (240 km/h; 149 mph)

SCHEIBE

SCHEIBE AIRCRAFT GMBH

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Original Scheibe company produced or licenced almost 1,500 gliders since it was founded at Dachau on 31 October 1951 by the late Dipl Ing Egon Scheibe. Most recent motor glider production comprised the steel tube and wood SF 25C Falke and Rotax Falke. New SF 41 revealed in 2005. In November 2005 the company filed for bankruptcy; on 30 April 2006 Scheibe terminated aircraft production and transferred responsibility for support of company products to Sammet GmbH at Heubach aerodrome. A new company was immediately formed at Heubach, holding type certificates for all Scheibe types except SF 23, 34, 36 and 41.

SCHEIBE SF 25C FALKE

TYPE: Motor glider.
 PROGRAMME: Bergfalke sailplane first flew 5 August 1951; motorised as SF-25A Motor Falke; D-KEDO first flew May 1963. Built in several versions, including under licence by Sportavia-Pützer (Germany) and Slingsby (UK, as T.61).
 SF 25C version first flew (D-KBIK) in March 1971 and gained its type certificate in September 1972; FAA certification April 2001. Falke 1700, with 48.5 kW (65 hp) Limbach 1700 engine discontinued. Falke 2100, with Sauer SS2100 engine, tested 1988 (D-KIAC), but only two others built.
 Falke production at Dachau ended in May 2006, but reformed Scheibe Aircraft transferred production to Heubach.
 CURRENT VERSIONS: **Falke 2000:** Limbach L 2000 EA flat-four engine; monowheel landing gear or conventional tailwheel with two mainwheels available.
Rotax Falke: Prototype D-KIAJ flown 1989. Has essentially the same performance as Falke 2000, but is powered by a water-cooled Rotax 912 A or, from 1999, Rotax 912 S flat-four engine; nosewheel landing gear optional. Most production now of this version; some earlier Falkes have been upgraded with Rotax engines. Tricycle landing gear first tested on Falke 2000 D-KBUG in 1987; deliveries from 1990.
Superschlepper: Glider tug version; has max T-O weight of 600 kg (1,323 lb), in this mode. Rotax 912 A or 912 S. Towing trials by D-KIEK in 1998-99.
SF 41 Zwergfalke: Short-span VLA version; described separately.
 CUSTOMERS: Total of 1,276 SF 25s of all types delivered by mid-2006, including 715 SF-25Cs by the original Scheibe firm. More than 100 Rotax Falkes used as glider tugs.

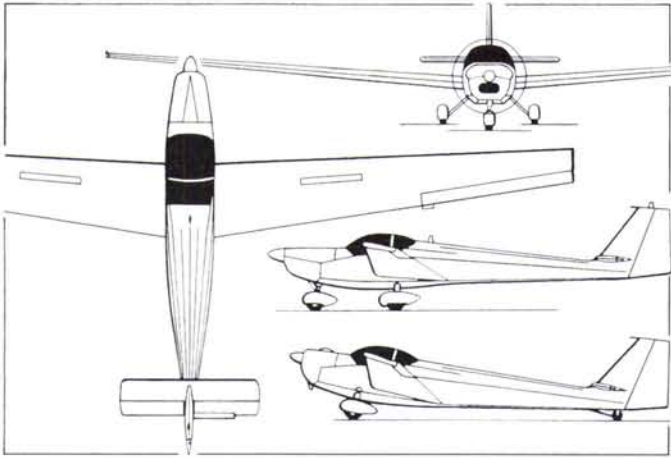
COSTS: Falke 2000 with Limbach engine and monowheel landing gear, EUR90,060; nosewheel landing gear EUR3,130 extra; Rotax Falke EUR89,440 with 912 A, EUR91,380 with 912 S (nose-gear versions respectively EUR3,150 and EUR3,110 extra (all prices 2003)).
 DESIGN FEATURES: Docile aerofoil with moderate aspect ratio, designed for safe and simple handling; aircraft can be easily dismantled and transported by trailer. Mid-mounted wing with taper and slight forward sweep; constant chord tailplane; sweptback fin. Various landing gear and engine options.
 FLYING CONTROLS: Conventional and manual. Door-type wing spoilers at one-third span; upper wing only. Trim tab on starboard aileron; 13 mm (0.5 in) endplates on wing.
 STRUCTURE: Steel tube and fabric fuselage; wooden wing and empennage; wing fabric-covered rearwards from one-third chord; fabric-covered elevators and fin.
 LANDING GEAR: Fixed standard landing gear is central monowheel, outriggers under wings, and tailwheel; two-wheel, fuselage-mounted, sprung cantilever main landing gear with steerable tailwheel, and tricycle landing gear (only at 650 kg MTOW), are optional; mainwheels and nosewheel (where fitted) 5.00-4.
 POWER PLANT: **Rotax Falke:** One 59.6 kW (79.9 hp) Rotax 912 A with water-cooled cylinder heads, running at 5,800 rpm and turning the propeller at 2,500 rpm; or a 73.5 kW (98.6 hp) Rotax 912 S running at 5,800 rpm and turning the propeller at 2,380 rpm.
Falke 2000: One 59.7 kW (80 hp) Limbach L 2000 EA driving the propeller at 3,450 rpm. All engines have electric starter and alternator; propeller feathering optional. Glider tug has MTV-1-A/175-05 constant-speed (for Rotax 912 A) or MT 175R130-2A fixed-pitch (for Rotax 912 S) propeller.
 Standard fuel tankage (all versions) is 55 litres (14.5 US gallons; 12.0 Imp gallons); optional fuel tankage 80 litres (21.1 US gallons; 17.6 Imp gallons).
 ACCOMMODATION: Side-by-side seating under forward-hinged canopy; optional large cockpit opening. Dual controls standard; instrument panel space for radio.
 SYSTEMS: 12 V electrical system.
 AVIONICS: Choice of optional Bendix/King or Becker nav/com radios.
 DIMENSIONS, EXTERNAL:
 Wing span 15.30 m (50 ft 2¼ in)
 Wing aspect ratio 12.9
 Length overall: except Rotax Falke 7.60 m (24 ft 11¼ in)
 Rotax Falke 7.78 m (25 ft 6¼ in)
 Height overall: tailwheel 1.68 m (5 ft 6¼ in)
 nosewheel 2.50 m (8 ft 2½ in)
 DIMENSIONS, INTERNAL:
 Cockpit max width 1.00 m (3 ft 3¼ in)
 AREAS:
 Wings, gross 18.20 m² (195.9 sq ft)
 WEIGHTS AND LOADINGS (Rotax 912 A):
 Manufacturer's weight empty 448 kg (988 lb)
 Fuel weight: standard 40 kg (88 lb)
 optional 58 kg (128 lb)
 Max T-O weight 650 kg (1,433 lb)



Scheibe Rotax Falke with twin mainwheels and tailwheel (Paul Jackson)

1128911

Max wing loading	35.7 kg/m ² (7.31 lb/sq ft)
Max power loading	10.90 kg/kW (17.91 lb/hp)
PERFORMANCE, POWERED (L: Limbach, A: Rotax 912 A, S: Rotax 912 S, fixed-pitch (FP) or constant-speed (CS) propeller):	
Max level speed (all)	102 kt (190 km/h; 118 mph)
Cruising speed: L	81 kt (150 km/h; 93 mph)
A	92 kt (170 km/h; 106 mph)
S	97 kt (180 km/h; 111 mph)
Stalling speed (all)	35 kt (65 km/h; 41 mph)
Max rate of climb at S/L: L	192 m (630 ft)/min
A: FP	240 m (787 ft)/min
CS	288 m (945 ft)/min
S: FP	300 m (984 ft)/min
CS	330 m (1,082 ft)/min
T-O run: L	140 m (460 ft)
A	100 m (330 ft)
S	90 m (295 ft)
Range, standard fuel:	
L, A	378 n miles (700 km; 435 miles)
S	324 n miles (600 km; 372 miles)
Endurance, standard fuel:	
L	4–5 h
A	4 h 30 min
S	4 h
PERFORMANCE, UNPOWERED:	
Best glide ratio	23–24
Min rate of sink	1.10 m (3.61 ft)/s



Tri-gear Scheibe SF 25C Falke powered by Rotax 912 A engine, with second side view (lower) of Falke 2000 with conventional landing gear (Mike Keep)

1158927

PROGRAMME: VLA lightplane version of SF 25C Rotax Falke, apparently replacing development of ultralight version following 1998 suspension of SF 40C Allround described in earlier editions of *Jane's All the World's Aircraft*. Prototype (D-EESF) shown at Aero '05, Friedrichshafen, May 2005, when maiden flight said to be due "very soon"; not reported by mid-2006, when Scheibe company was closed. Re-established Scheibe Aircraft has no plans to launch production.

SCHEIBE SF 41 ZWERGFALKE

English name: Merlin
TYPE: Two-seat lightplane.

SILENCE

SILENCE AIRCRAFT

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PARTNERS:
Matthias Strieker
Thomas Strieker
Michael Rudbach
Herbert Funke

Silence's first project is an ultralight kitbuilt with flying surfaces similar in shape to those of the Supermarine Spitfire. Until late 2003, the aircraft also was known as Silence, but is now designated Twister. In July 2003, a new company, Silence Flugzeugbau, was established by sailplane manufacturer DG Flugzeugbau to build and market the Twister in conjunction with designers Matthias and Thomas Strieker. Manufacture is being undertaken at Verl.
Silence has designed its own propeller for the Twister (e-mail: t.strieker@silencedesign.de).

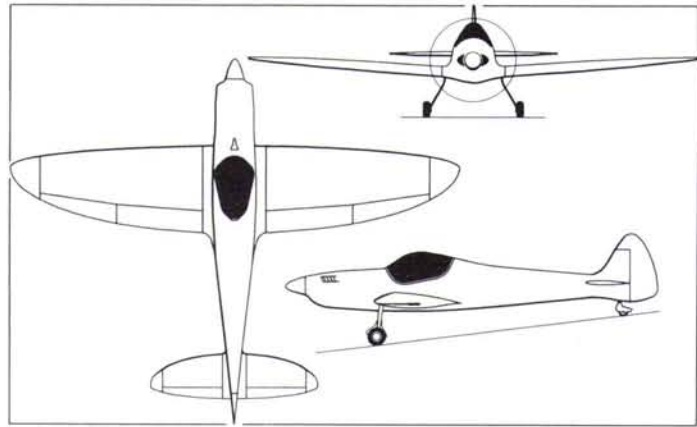
SILENCE TWISTER

TYPE: Single-seat ultralight/kitbuilt.
PROGRAMME: Developed over a period of four years in a garden gazebo. Prototype (D-MTMH, incorporating partners' initials) made first flight 30 September 2000; LBA certification



Silence Twister built in UK (Paul Jackson)

1159353



Silence Twister single-seat ultralight (Paul Jackson)

1159390

STRUCTURE: Monocoque single-piece fuselage of composites, with honeycomb core, Kevlar sandwich safety-cell centre-section, similar to Formula 1 motor-racing cars, incorporating pilot's seat and attachments for wing spar, landing gear and ballistic parachute. Single-piece wing spar. Aerofoil Stuttgart LWK180/25.

LANDING GEAR: Tailwheel type. Electric retraction; carbon fibre main legs rotate 90° and retract rearwards. Tailwheel non-retractable. Mainwheels 14x4. Hydraulic brakes.

POWER PLANT: Engines in the region of 70 kW (93.9 hp) can be fitted, to drive a three-blade, ground-adjustable pitch Helix carbon fibre propeller; prototype SA155 had 40 kW (53.6 hp) Wankel engine. Twister has 59.7 kW (80 hp) Jabiru 2200 flat-four driving a three-blade Silence carbon fibre propeller. Fuel capacity 80 litres (21.1 US gallons; 17.6 Imp gallons) of which 75 litres (19.8 US gallons; 16.5 Imp gallons) is usable.

EQUIPMENT: Junkers ProFly or BRS 1050 ballistic parachute system.

DIMENSIONS, EXTERNAL:

Wing span	7.50 m (24 ft 7¼ in)
Length overall	6.18 m (20 ft 3¼ in)
Height overall	1.44 m (4 ft 8¾ in)

AREAS:

Wings, gross	8.72 m² (93.9 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty: SA155	200 kg (441 lb)
Twister	215 kg (474 lb)
Max T-O weight	340 kg (749 lb)

PERFORMANCE:

Never-exceed speed (VNE)	162 kt (300 km/h; 186 mph)
Cruising speed: SA155	108 kt (200 km/h; 124 mph)
Twister	130 kt (240 km/h; 149 mph)
Stalling speed: both	35 kt (65 km/h; 41 mph)
Max rate of climb at S/L: SA155	330 m (1,083 ft)/min
Twister	510 m (1,673 ft)/min
T-O run: Twister	90 m (295 ft)
Landing run: Twister	122 m (400 ft)
Range with max fuel: Twister	702 n miles (1,300 km; 807 miles)
g limits	+6/-4

STEMME

STEMME AG

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Founded in 1985, Stemme was originally based in Berlin but moved to nearby Strausberg airfield in 1991; current factory area is 3,000 m² (32,292 sq ft); workforce of 45 at beginning of 2003. The 100th aircraft was delivered in September 1998. Turnover was EUR4 million in 2001 and was forecast to increase to EUR20 million in 2005.

Stemme's first aircraft design, the S10 high-performance motor glider, introduced an unorthodox light aircraft concept by combining a modular airframe with the engine mounted amidships and driving a front-mounted propeller with retractable blades. Some 180 have been delivered, in three different versions. Current product range also includes the S2 (originally S7), a two-seat competition sailplane, which was expected to fly in September/October 2006.

In 2005, S10 series was to be followed by new range of two-seat aircraft (TSA programme), a modular family of side-by-side sport aircraft comprising the S2 sailplane, S6 soaring motor glider and S8 touring motor glider, of which the S6-RT was expected to fly in July 2006 and the S8 in 2007.

Research and development is undertaken by subsidiary Stemme F&D (Flugzeuge und Dienstleistungen). Subsidiary Stemme UMS (Umwelt-Messflug-Systeme) is developing the S15-8 entry-level surveillance version and the S8-Safari for semi-professional use.

STEMME S10 and S15

US marketing name: Chrysalis
US Air Force designation: TG-11A
TYPE: Motor glider.

PROGRAMME: Prototype (D-KKST), with Glaser-Dirks DG500 wing, flown 6 July 1986; first flight of second prototype (D-KCHS) with definitive wing 2 June 1987; S10-VC surveillance and observation platform introduced in 1989; designed to JAR 22. Certified in Germany 31 December 1990, in UK 29 October 1991 and in USA, to FAR Pt 21, 8 July 1992. Production of S10 suspended March 1994; resumed late 1994 until 1997 with S10-V and since then with S10-VT.

CURRENT VERSIONS: **S10:** Original version, with 69.4 kW (93 hp) Limbach L 2400 EB1.AD flat-four engine and retractable fixed-pitch propeller; 54 produced until March 1994, including prototypes.

S10-VC: Surveillance/observation conversion with underwing and small wingtip sensor pods for pollution control and resources investigation. One former S10 (D-KGCM/N600PL) used by Greenpeace since May 1994; one former S10-V (PH-1055) operated by Aerial Surveillance den Hollander, Netherlands, since 1995.

S10-V: Variable-pitch propeller version; power plant as for S10. Demonstrator (D-KGCX) completed mid-1994 as conversion of S10 but written off in Tanzania 10 March 1995; certified September 1994; total of 29 built between late 1994 and 1997; further five, or more, conversions from S10; production completed. (S10-V has engineering designation S14.)

S10-VT: Current production version with turbocharged Rotax 914 engine and variable-pitch propeller. Prototype (D-KGCR) built 1997; LBA certification August 1997, FAA certification September 1997 and CAA certification May 1998; total of 95 produced by mid-2005; of these, at least 39 to USA. (S10-VT has engineering designation S11.) Set world soaring record (D-KMTF) of 1,330 n miles (2,463 km; 1,530 miles) on 26 November 2000, piloted by Klaus Ohlmann.

Following description applies to S10-VT, except where indicated.

S15: Launched at the 1996 Berlin Air Show; Rotax 914 engine and a 20.00 m (65 ft 7½ in) wing span; two underwing hardpoints for sensor pods in law-enforcement or scientific research roles suitable for loads up to 65 kg (143 lb) each, including FLIR, Nightsun searchlights, video cameras, and environmental monitoring equipment being developed by Berlin Technical University's Geography Institute. Prototype (D-ESTE) registered 1996, but no record of completion. S15B, light surveillance version, based on S10-VT, was then due to enter service in 2002, followed by S15A advanced surveillance model in 2004; both sponsored by Deutsche Bundesstiftung Umwelt. First S10-VT (D-KGCR) shown at Berlin, June 2000 (and again in May 2002) as POC S15. Now superseded by S15-8 (see separate entry).

Busard: Optionally piloted version (Buzzard), under development by ONERA and SAGEM as testbed for UAV sensor payloads.

Irkut-850: Optionally piloted version; similar in concept to Busard; being promoted by Irkut of Russian Federation in 2006.

Condor: Medium-altitude long-endurance (MALE) manned or unmanned version proposed jointly in 2004 by OHB System (Germany) and Elop (Israel); would use Stemme S10-VT airframe, modified to V-tail configuration and possibly turboprop- or Diesel-powered, although version considered with podded turbofan above fuselage, immediately ahead of tailfins. Sensor-carrying capabilities generally similar to those of Stemme S15-8, with Thales Optronique Agile E-O/R turret offered as standard mission payload.

S-UAV: Unpiloted surveillance conversion. One S10-V (N600V) used as testbed by Platforms International Corporation, Mojave, California.

CUSTOMERS: Owners in Australia, Austria, Belgium, Brazil, Canada, Czech Republic, Denmark, Finland, France, Germany, Italy, Mexico, Netherlands, New Zealand, South Africa, Spain, Switzerland, UK and USA. Two delivered in 1995 to 94th Air Training Squadron, USAF Academy, Colorado Springs, Colorado. Total of 183 S10 variants (including prototypes) built by mid-2006; 100th production S10-VT (confusingly D-KILO) completed in mid-2006 for Italian customer.

COSTS: S 10-VT EUR168,000 basic (2003).

DESIGN FEATURES: Three-part shoulder-wing, T-tail motor glider with mid-mounted engine and completely retractable nose-mounted propeller. Transition time between soaring and powered flight is 5 seconds. Winglets option introduced from 1997. Outer wings can be folded by one person for ground handling and hangarage; wing sections carried in gantries inside trailer so that one person can fit centre and outer sections straight from trailer to fuselage.

Wing section Horstmann & Quast laminar flow HQ41/14.35; dihedral 1°; no twist.

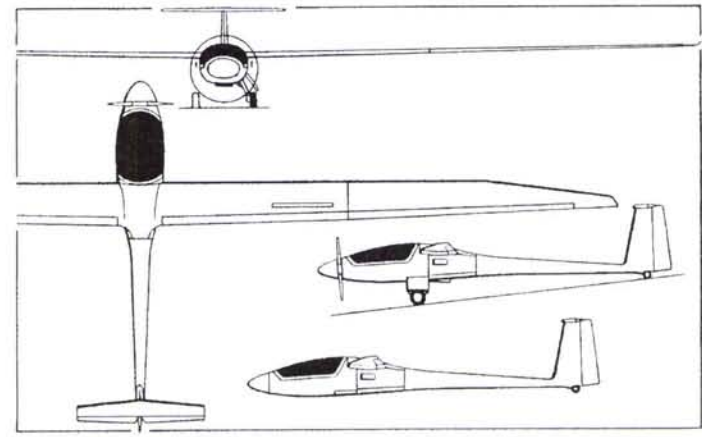
FLYING CONTROLS: Conventional and manual. Full-span, six-position (-10°/-5.0°/+5.0°/+10°/+16°) trailing-edge flaps, outer segments of which function also as ailerons. Flap/aileron linkage for manoeuvrability and docility at low airspeeds; Schempp-Hirth airbrakes in outer ends of wing centre-section.

STRUCTURE: CFRP wings in three sections detachable from fuselage; CFRP rear fuselage and tail mounted to steel tube centre frame carrying wing, engine and landing gear; cockpit section, of CFRP structure with Kevlar safety lining, mounted at front of centre frame. Engine fully accessible and horizontal firewall separates engine from wing and flying controls. Winglets optional. Airframe made in Poland by Wytownia Konstrukcji Kompozytowych, ulitsa Strumienska 829A, PL-43-385 Jasienica; telephone (+48 33) 815 33 31; fax (+48 33) 815 33 07; e-mail wkkpapiorek@pro.onet.pl.

LANDING GEAR: Tailwheel type; electrically actuated, inward-retracting, narrow track mainwheels; non-retractable tailwheel, steered by rudder. Mainwheel tyres 5.00-5 or 6.00-5, with electrically actuated, mechanical standby disc brakes. Tailwheel: 210x65 tyre; fairing standard.

POWER PLANT: One 84.6 kW (113.4 hp) Rotax 914 F2/S1 turbocharged liquid/air-cooled flat-four engine mounted in the central fuselage steel tube frame aft of cockpit and driving a two-blade, variable-pitch retractable propeller via a centrifugal clutch, a CFRP extension shaft and a reduction gear. Engine cooling by adjustable ram air intake. Nosecone is moved forward and spring-folded blades emerge through peripheral slot under centrifugal force.

Fuel in two 45 litre (11.9 US gallon; 9.9 Imp gallon) fuel tanks in outer ends of centre wing; 60 litre (15.8 US gallon; 13.2 Imp gallon) tanks optional. Total capacities 90 litres (23.8 US gallons; 19.8 Imp gallons) or 120 litres (31.7 US gallons; 26.4 Imp gallons).



Stemme S10-VT showing additional side view (left) with landing gear and propeller retracted (Mike Keep) 1159100



Stemme S10-VT equipped for surveillance with camera turret beneath port wing (Paul Jackson)

1128912

ACCOMMODATION: Two pilots side by side; dual controls standard; seats adjustable for position and rake; one-piece canopy hinged at forward end and held open by gas struts.
SYSTEMS: 12 V electrical system: full night lighting, landing light and solar cells optional. Solar cells can be fitted behind cockpit to provide 12 V 37.5 W.

AVIONICS: Comms: Intercom, VHF radio and transponder optional, as is special cut-down panel for mountain soaring.

DIMENSIONS, EXTERNAL:	
Wing span, excl winglets	23.00 m (75 ft 5½ in)
Wing aspect ratio	28.3
Width, wings folded	11.40 m (37 ft 4¾ in)
Length overall	8.42 m (27 ft 7½ in)
Fuselage max width	1.18 m (3 ft 10½ in)
Height over tailplane	1.80 m (5 ft 10¾ in)
Wheel track	1.15 m (3 ft 9¼ in)
Wheelbase	5.42 m (17 ft 9½ in)
Propeller diameter	1.63 m (5 ft 4¼ in)
Fuselage ground clearance at mainwheels	0.72 m (2 ft 4¼ in)

DIMENSIONS, INTERNAL:	
Cockpit: Width	1.16 m (3 ft 9½ in)
Height	0.93 m (3 ft 0½ in)

AREAS:	
Wings, gross	18.70 m² (201.3 sq ft)
Vertical tail surfaces (total)	1.51 m² (16.25 sq ft)
Horizontal tail surfaces (total)	1.46 m² (15.72 sq ft)

WEIGHTS AND LOADINGS:	
Weight empty	660 kg (1,455 lb)
Max T-O and landing weight	850 kg (1,874 lb)
Max wing loading	45.5 kg/m² (9.31 lb/sq ft)
Max power loading	10.06 kg/kW (16.53 lb/hp)

PERFORMANCE, POWERED:	
Never-exceed speed (VNE), smooth air	146 kt (270 km/h; 168 mph)
Manoeuvring speed	97 kt (180 km/h; 112 mph)
Max cruising speed: at S/L	121 kt (225 km/h; 139 mph)

at FL100	134 kt (248 km/h; 154 mph)
Stalling speed, flaps down	42 kt (78 km/h; 48 mph)
Max rate of climb at S/L	249 m (817 ft)/min
Service ceiling	9,140 m (30,000 ft)
T-O run	205 m (675 ft)
T-O to 15 m (50 ft)	447 m (1,465 ft)
Max range:	
standard fuel	696 n miles (1,290 km; 801 miles)
max optional fuel	928 n miles (1,720 km; 1,068 miles)

PERFORMANCE, UNPOWERED:	
Best glide ratio at 57 kt (106 km/h; 66 mph)	50
Min rate of sink at 45 kt (83 km/h; 52 mph)	0.57 m (1.87 ft)/s
g limits	+5.3/-2.65

OPERATIONAL NOISE LEVELS:	
To German light aircraft rules (LSL Chapter X)	71.3 dBA

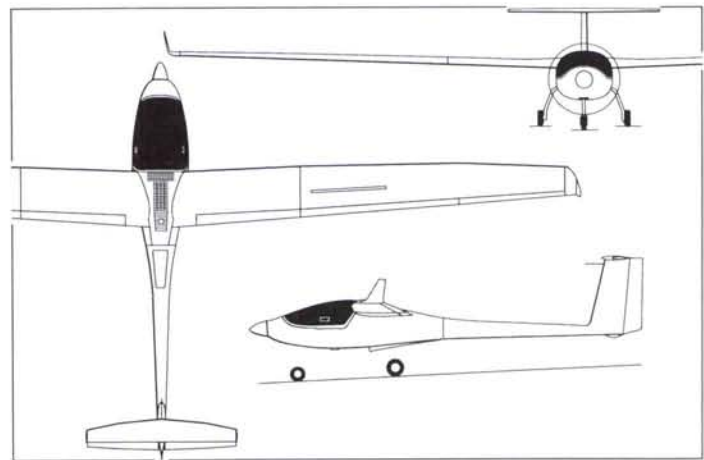
STEMME S6, S8 and S15-8

TYPE: Motor glider.
PROGRAMME: Development nearing completion in late 2002 of modular family known as TSA (two-seat aircraft) and comprising S2 glider (two versions); S6 motor glider (five versions); and S8 motor glider (six versions). S8 announced at ILA, Berlin, May 2000; S6 at Aero '01, Friedrichshafen, April 2001. Deliveries of S6 were scheduled to begin in second quarter 2003, but revised schedule as at April 2005 forecast S6 maiden flight for August 2005. This not achieved. Structural testing under way in February, March and April 2006, with first flight (S6-RT prototype) then predicted in July 2006 and first deliveries at year-end; S2 to be next to fly, then S8 in 2007.
CURRENT VERSIONS: **S6:** Soaring motor glider with large one-piece canopy, fixed tricycle landing gear and naturally aspirated Rotax 912 S engine. Suitable for towing gliders of up to 750 kg (1,653 lb) MTOW.
S6-L: As S6 except for lower MTOW.
S6-T: As S6, but turbocharged Rotax 914 F engine.
S6-R: As S6, but fully retractable tricycle landing gear.



Prototyp Stemme S6 displayed, semi-complete, at Berlin in May 2006 (Paul Jackson)

1158102



Stemme S6 general arrangement (Paul Jackson)

1046949

S6-RT: As S6, but turbocharged Rotax 914 F and retractable tricycle landing gear.
S8: Touring motor glider with roomier cockpit and door on each side; otherwise as S6.
S8-T: As S8, but turbocharged Rotax 914 F.
S8-R: As S8, but retractable tricycle landing gear.
S8-RT: As S8, but turbocharged Rotax 914 F and retractable tricycle landing gear.
S8-Safari: Derivative of S8, S8-R, S8-T or S8-RT with hardpoints and underwing pods for semi-professional use.

S15-8: Light reconnaissance and surveillance aircraft for manned or MALE (medium-altitude, long-endurance) unmanned (UAV) missions. Derived from S8-T or S8-RT for governmental or commercial applications. Hardpoints for external loads; quick-change underwing mission equipment pods. Sensor payloads can include day/night E-O, SAR, lidar, imaging spectrometer and digital photogrammetric cameras; sensor fusion and integration with GPS/INS available.

DESIGN FEATURES: Based on platform strategy with S10 design principles, including proven propulsion system with mid-mounted engine, driveshaft and front propeller. New features include non-retractable constant-speed propeller with feathering for soaring mode, tricycle landing gear and task-adapted, low-drag aerodynamics. In area of wing/fuselage junction a geometric twist is combined with specially designed turbulent flow aerofoils, which minimise separations of boundary layer. Ease of maintenance through rapid change potential of power plant (engine, from drive flange to end of muffler, is mounted on a subframe), landing gear and propeller driveshaft group. Innovative engine installation offers upward exhaust emission for a noise level far below international limit.

FLYING CONTROLS: Primary controls (elevator, ailerons, rudder) conventional and manual; full dual controls. Secondary controls (flaps, trim, airbrakes). Electric trim. Manually actuated flaps. Advanced flap/aileron linkage for middle and outer wing control surfaces. Schempp-Hirth airbrakes in outer wings.

STRUCTURE: CFRP wings in three sections, plus winglets. Wing detachable from fuselage; CFRP tailcone and tail unit mounted to centre steel framework accommodating engine and landing gear; safety cockpit with different types of composites.

LANDING GEAR: Tricycle type, fixed; or electrically actuated fully retractable (see Current Versions). Former has speed fairings on all wheels. Mainwheels size 380x150, nosewheel 300x100.

POWER PLANT: Except T and RT versions: One 73.5 kW (98.6 hp) Rotax 912 S flat-four engine, mounted on subframe aft of cockpit and driving a two-blade (optionally three-blade) constant-speed propeller via a CFRP extension shaft and a reduction gear.

T and RT versions and S15-8: One 84.5 kW (113.3 hp) turbocharged Rotax 914 F flat-four; five-blade MTV-Propeller in S15-8; otherwise as described in preceding paragraph.

Standard fuel capacity (S6) 70 litres (18.5 US gallons; 15.4 Imp gallons); 140 litres (37.0 US gallons; 30.8 Imp gallons) optional for S6-T and S6-RT, standard for S8 variants. Additional option in S15-8 for 230 litre (60.8 US gallon; 50.6 Imp gallon) long-range tank and/or two 65 litre (17.2 US gallon; 14.3 Imp gallon) underwing tanks.

ACCOMMODATION: Pilot and passenger/student side by side in S6, under single-piece, forward-hinged canopy. More spacious cockpit in S8 versions, with door each side.

SYSTEMS: As described for S10.

AVIONICS: Comms: VHF radio and intercom.

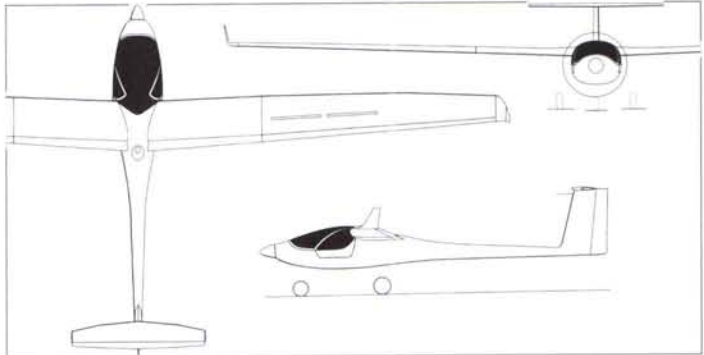
Flight: VOR; GPS; ATC transponder.

Instrumentation: Moving map; soaring computer.

Following data are as projected in late 2002:

DIMENSIONS, EXTERNAL (all):

Wing span 18.00 m (59 ft 0 3/4 in)
Wing aspect ratio 18.6
Width, wings folded 7.20 m (23 ft 7 1/2 in)



Stemme S8 motor glider (Paul Jackson)

0535823

Length overall 8.52 m (27 ft 1 1/2 in)
Height to top of tail 2.45 m (8 ft 0 1/2 in)
Wheel track: S6 2.00 m (6 ft 6 3/4 in)
S8 1.80 m (5 ft 10 3/4 in)
Wheelbase 2.00 m (6 ft 6 3/4 in)

AREAS:
Wings, gross 17.40 m² (187.3 sq ft)
Vertical tail surfaces (total) 1.50 m² (16.15 sq ft)
Horizontal tail surfaces (total) 1.74 m² (18.73 sq ft)

WEIGHTS AND LOADINGS:
Weight empty: S6 603 kg (1,329 lb)
S6-L 583 kg (1,285 lb)
S6-R 587 kg (1,295 lb)
S6-T 629 kg (1,387 lb)
S6-RT 599 kg (1,321 lb)
S8, S15-8 587 kg (1,294 lb)
S8-R 592 kg (1,305 lb)
S8-RT 630 kg (1,389 lb)
Max T-O weight: except S6-L 850 kg (1,873 lb)*
S6-L 800 kg (1,764 lb)

Max wing loading:
except S6-L 48.8 kg/m² (10.00 lb/sq ft)
S6-L 46.0 kg/m² (9.42 lb/sq ft)

Max power loading:
Rotax 912 S (except S6-L) 11.56 kg/kW (19.00 lb/hp)
S6-L 10.89 kg/kW (17.89 lb/hp)
Rotax 914 F 10.06 kg/kW (16.53 lb/hp)

* S15-8 950 kg (2,094 lb) with special C of A

PERFORMANCE, POWERED (estimated, with two-blade propeller: A: S6-RT, B: S8-RT, C: S15-8):

Max level speed at S/L:
A, B, C 151 kt (280 km/h; 174 mph)
Max level speed at FL160: C 175 kt (324 km/h; 201 mph)
Max cruising speed at S/L:
at 55% power: A, B 130 kt (240 km/h; 149 mph)
C 114 kt (211 km/h; 131 mph)
Max cruising speed at FL100:
A, B 167 kt (310 km/h; 193 mph)
Max rate of climb at S/L: A 348 m (1,142 ft)/min
B 348 m (1,142 ft)/min
C 266 m (873 ft)/min
Service ceiling: A, B 8,535 m (28,000 ft)
C 7,620 m (25,000 ft)
Range at S/L, 140 litres fuel, 55% power:
A 1,295 n miles (2,400 km; 1,491 miles)
B 1,241 n miles (2,300 km; 1,429 miles)

PERFORMANCE, UNPOWERED:

Best glide ratio:
S6, S6-T at 61 kt (113 km/h; 70 mph) 33
S6-R, S6-RT at 64 kt (119 km/h; 74 mph) 39
S8, S8-RT at 63 kt (117 km/h; 72 mph) 32
S8-R, S8-RT at 66 kt (122 km/h; 76 mph) 38
Min rate of sink at empty weight +70 kg (154 lb):
S6, S6-T 0.85 m (2.79 ft)/s
S6-R, S6-RT 0.73 m (2.40 ft)/s
S8, S8-T 0.86 m (2.82 ft)/s
S8-R, S8-RT 0.74 m (2.43 ft)/s

ULBI

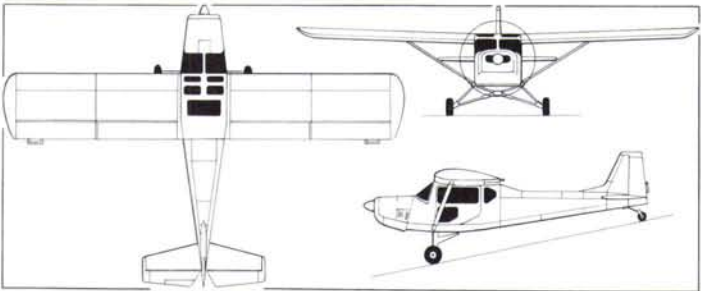
ULTRALEICHTBAU INTERNATIONAL

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CEO: Angelika Kaiser
SALES MANAGER: Alfred Kaiser
CHIEF DESIGNER: Rainer Kurtz
CHIEF TEST PILOT: 'Biggi the Rottweiler'

The Romanian-developed Wild Thing lightplane has been marketed by Ultraleichtbau, known until 2001 as Air Light, since 1997. A nosewheel version was introduced in 1999.
In addition to the Wild Thing range, ULBI also markets the Jabiru and Corvus series of kitbuils.

ULBI WILD THING

TYPE: Side-by-side ultralight/kitbuilt.
PROGRAMME: Developed by Aerostar (which see) in Romania; prototype registered YR-6107. Launched at Friedrichshafen Air Show, April 1997; certification August 1997. Initial production aircraft had Jabiru 2200 engines; alternatives available from 1998. By early 2001, examples were operating in Austria, Czech Republic, France, Germany, Hungary and Netherlands.
CURRENT VERSIONS: **WT-01:** Baseline version; tailwheel.
WT-02: Nosewheel version introduced early 1999 (D-MWTA, 50th production aircraft, as demonstrator).
CUSTOMERS: Total of 90 built by 2005; five sold in Germany during 2004. Incomplete 91st airframe shown in seaplane configuration at ILA, Berlin, May 2006.
COSTS: EUR49,900 (Jabiru 2200) or EUR59,300 (Jabiru 3300); nosewheel EUR3,950 extra; all excluding tax (2006). Rotax-engined version prices on application.
DESIGN FEATURES: Bears strong outward resemblance to Canadian Murphy Rebel. Built by Aerostar in Romania for distribution out of Germany. Wings fold alongside fuselage for storage or transportation on aluminium trailer.
FLYING CONTROLS: Conventional and manual. Frise ailerons. Elevators and ailerons pushrod-operated, rudder Cable-operated. Horn-balanced tail surfaces; trim tab in port elevator; ground-adjustable tab on rudder. Flaps.
STRUCTURE: Main structure is metal monocoque, with fabric-covered ailerons and flaps.
LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted. WT-01 has two faired-in side Ys plus half-axes, each with bungee cord shock-absorber, attached to compression frame. Mainwheel size 8.00-6, tailwheel size 200x50. Oversize Tundra wheels and tyres optional.



ULBI WT-01 Wild Thing (James Goulding)

0137227

Cable-operated disc brakes. WT-02 has spring cantilever mainwheel legs with attachment point further aft and nosewheel with compressed rubber shock-absorber; nosewheel size 140x6.
POWER PLANT: One 59.7 kW (80 hp) Jabiru 2200, 59.6 kW (79.9 hp) Rotax 912 UL, 78.3 kW (105 hp) Mid West Hawk, 89.5 kW (120 hp) Jabiru 3300 or 73.5 kW (98.6 hp) Rotax 912 ULS driving a two-blade Helix fixed-pitch carbon fibre ground-adjustable pitch, carbon fibre or Kremen SR 2000 XC three-blade, variable-pitch (electric) wooden propeller. Fuel in two wing tanks, combined capacity 80 litres (21.1 US gallons; 17.6 Imp gallons); can be upgraded to large tanks with combined capacity of 120 litres (31.7 US gallons; 26.4 Imp gallons).
ACCOMMODATION: Prototype had third seat in rear of cabin, hence a spacious cockpit area.
AVIONICS: Becker, Filser and Icom avionics to customer's choice.
EQUIPMENT: Junkers Magnum speed parachute emergency rescue system and gliding towing equipment both optional.
DIMENSIONS, EXTERNAL:
Wing span 9.20 m (30 ft 2¼ in)
Length overall 6.90 m (22 ft 7¾ in)
Height overall 1.92 m (6 ft 3½ in)
AREAS:
Wings, gross 13.94 m² (150.0 sq ft)
WEIGHTS AND LOADINGS:
Weight empty (typical) 290 kg (639 lb)
Max T-O weight 472.5 kg (1,041 lb)
PERFORMANCE (Jabiru 2200 engine):
Never-exceed speed (VNE) 108 kt (200 km/h; 124 mph)
Max level speed 97 kt (180 km/h; 112 mph)
Cruising speed 76 kt (140 km/h; 87 mph)
Stalling speed 32 kt (58 km/h; 36 mph)
Max rate of climb at S/L 152 m (500 ft)/min
T-O run 98 m (320 ft)
Landing run 44 m (145 ft)
Range with max fuel 432 n miles (800 km; 497 miles)



ULBI WT-01 Wild Thing (Paul Jackson)

1159354

WD

WD FLUGZEUGLEICHTBAU GMBH

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Web: www.uljih.cz
EXECUTIVE DIRECTOR: Jaroslav Sedláček

Formed in 1982, WD Flugzeugleichtbau marketed the Fascination D4 BK and D5 Evolution. The earlier D3 Sunwheel was also available; Final project was the Revolution competition aerobatic aircraft.
In 1999, WD opened a new production facility in the Czech Republic, where kits and complete aircraft are manufactured.
In June 2005, WD was declared insolvent and the assets of the company offered for sale; the type rights were sold to Swiss Light Aircraft AG in early 2006.

WQS

WUST QUALITY SYSTEMS

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e-mail: mail@wuestenflug.de
Web: www.mark-wuest.de
FOUNDER: Wolfgang Wüst

Wüst GmbH was founded in October 2001 and in December 2001 acquired the assets of the former Mark GmbH Flugzeugbau. In 2004 the company was renamed Wüst Quality Systems GmbH (WQS). Development and production facilities are located in the Czech Republic. Test flying of the Seahawk II prototype was continuing in 2005.

WQS SEAHAWK II

TYPE: Two-seat amphibian ultralight kitbuilt.
PROGRAMME: Scale model of Seahawk I built by Mark GmbH for preliminary tests; mockup displayed at Aero 2001 at Friedrichshafen April 2001; redesign by Wüst GmbH as Seahawk II began December 2001; prototype (OK-IU 02; later re-registered HA-XBW) completed January 2003 and first flown 29 March 2003, with test flying continuing during 2004 and 2005 at Hassfurt and Welzow, Germany, including water landings; manufacture of second prototype began September 2003.

DESIGN FEATURES: Single-step hull; parallel chord wing with turned-down wingtips forming narrow stabilising floats; sweptback fin with T tail configuration; upward-opening gullwing doors.

FLYING CONTROLS: Conventional and manual; one-piece horn-balanced elevator with trim tab; electrically actuated Fowler flaps. Dual controls standard.

STRUCTURE: Composites/honeycomb sandwich; single-spar wings.

LANDING GEAR: Retractable tricycle type; mainwheels retract upwards into sides of hull; nosewheel retracts forwards. Mainwheels on metal tube side Vs, hinged at top, with twin bracing struts mounted above and single oleo-pneumatic/helical spring (motorcar-type) shock absorber.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS or 74.6 kW (100 hp) Textron Lycoming O-200 flat-four, pylon-mounted above wing in pusher configuration and driving a three-blade, fixed-pitch or constant-speed propeller. Fuel contained in two wing tanks, combined capacity 90 litres (23.8 US gallons; 19.8 Imp gallons).

DIMENSIONS: EXTERNAL:

Wing span 8.38 m (27 ft 6 in)
Length overall 7.35 m (24 ft 1 1/4 in)
Height overall 2.65 m (8 ft 8 1/2 in)

WEIGHTS AND LOADINGS:

Weight empty 350 kg (772 lb)
Max T-O weight 549 kg (1,212 lb)
Max power loading (Rotax) 7.48 kg/kW (12.29 lb/hp)



Prototype WQS Seahawk II during water trials, with Hungarian registration

1037988

ZEPPELIN

ZEPPELIN LUFTSCHIFFTECHNIK GMBH

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VICE PRESIDENT: Michael Schieschke
HEAD OF ENGINEERING: Robert Gritzbaach
SALES: Dietmar Blasius
MARKETING AND PUBLIC RELATIONS: Marion Berg
CORPORATE COMMUNICATIONS: Andrea Sinclair

ZLT Zeppelin Luftschifftechnik was formed in September 1993 for the development and production of new technology (NT) airships. Luftschiffbau Zeppelin GmbH, of which ZLT is a subsidiary, was founded by Count Ferdinand von Zeppelin in 1908 and still exists under the auspices of the Zeppelin Foundation. It had a December 2005 workforce of 84 full-time personnel.

Corporate members 2005 (percentage shareholdings in parentheses) are ZF Friedrichshafen AG (49.0), Luftschiffbau Zeppelin GmbH (51.0), Deutsche Zeppelin Reederei (DZR) formed in January 2001 as 100 per cent subsidiary of Zeppelin Luftschifftechnik; will be developed as operator, pilot training school and service centre for latter's airships; first commercial service flown 15 August 2001 and over 50,000 passengers carried by 31 December 2005. (First-generation Zeppelin undertook initial passenger service on 24 June 1910.)

On 24 August 2005, agreement was reached between Luftschiffbau Zeppelin GmbH, the CargoLifter receiver and Air Brand GmbH (the company formed to realise the assets of CargoLifter) for transfer of the intellectual property rights from the CargoLifter insolvency to Luftschiffbau Zeppelin, which plans to utilise them in support of the development of larger airships, including the NT 14.

ZEPPELIN NT

TYPE: Helium semi-rigid airship.
PROGRAMME: Study group for revival of modern semi-rigid airships formed 1989; concluded that combination of vectored thrust and new constructional approach offers best solution,

resulting in NT programme; 10 m (32 ft 10 in) long, remotely controlled proof-of-concept model tested extensively in 1991. Design definition of N 07 series (originally designated N 05) completed late 1992; construction started October 1995, leading to completion in July 1997 and first flight (D-LZFN) on 18 September 1997 (69th anniversary of maiden flight (1928) of LZ 127 *Graf Zeppelin*) following public debut (April) at Friedrichshafen Air Show. Test flights undertaken from new airship base at Friedrichshafen Airport; damaged by gale in February 1999, but returned to test flying by following April; made 100th flight in August 1999; D-LZFN named *Friedrichshafen* 2 July 2000; flight test programme completed in December 2000 (more than 1,000 hours in approximately 250 flights); certified by LBA 26 April 2001. Being brought up to production standard in 2002; then to undertake minesweeping operations in Croatia; traffic monitoring duties during 2004 Olympic Games in Athens.

First production NT 07 airship (D-LZZR *Bodensee*, c/n 02) made maiden flight 19 May 2001; second (D-LZZF, c/n 03) entered construction in third quarter of 2000 and made its first flight 9 February 2003. First revenue-earning flight (by 02) 15 August 2001; had carried more than 23,000 fare-paying passengers by August 2003; sold to Japan March 2004, at which time had accumulated approximately 2,500 flying hours. On 27 October 2004 an NT 07 piloted by Steve Fossett and Hans-Paul Ströble set a new world record of 62 kt (115 km/h; 71.5 mph) for speed over a 1 km course. NT 07 redesignated NT 07-100 in early 2005.

One NT 07 leased to De Beers Group in 2005 for R&D in southern Africa in 'Diamonds for Development' initiative.

CURRENT VERSIONS: Zeppelin NT 07-100: As described.

Zeppelin NT 14: Enlarged version, for which go-ahead given on 10 February 2005, replacing earlier NT 13 proposal. Overall length 90 m (295.3 ft), maximum diameter 15.8 m (51.8 ft), overall height 21.4 m (70.2 ft), volume 13,500 m³ (476,750 cu ft), max payload 3,200 kg (7,055 lb). Commonality with NT 07-100 includes power plant, FBW system, flight deck, control surfaces, lightwing protection and ground support vehicles. Modified gondola for two pilots, 19 passengers and one flight attendant, plus galley and lavatory; envelope and landing gear strengthened.

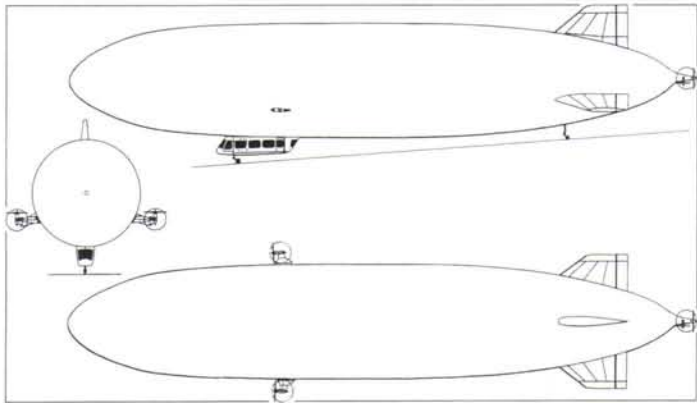
First example to fly late 2007 and be commercially operable; will be certified (as NT 07-200) to FAR/JAR 23; service entry third quarter 2008.

CUSTOMERS: First three NT 07-100 airships operated via DZR (Deutschen Zeppelin Reederei) subsidiary initially, to gain experience. D-LZZR purchased by Nippon Airship Corporation of Japan 2 March 2004; re-registered JA101Z and re-named *Yokoso! Japan* (Welcome to Japan); handed over in Friedrichshafen 12 June, departing following day on demonstration/delivery flight via 10 European countries (Switzerland, France, UK,



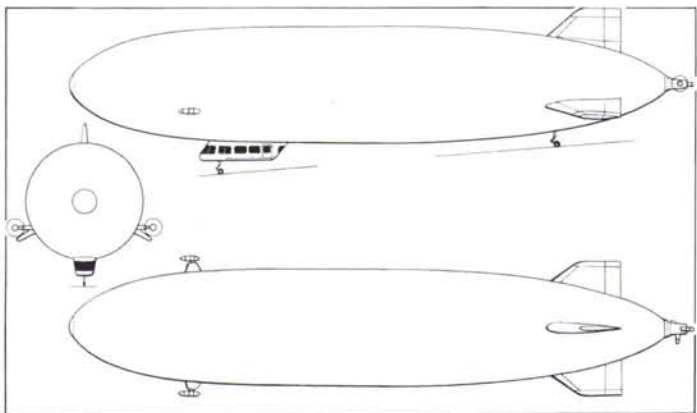
Zeppelin NT 07-100 prototype (Paul Jackson)

1128913



Zeppelin NT 07-100 airship (Paul Jackson)

1127534



Projected Zeppelin NT 14 (NT 07-200) airship (James Goulding)

1127535

Belgium, Netherlands, Luxembourg, Czech Republic, Denmark, Sweden and Finland). Was then due to cross Russia, but obstacles encountered in obtaining overflight clearance; journey aborted, and returned to Friedrichshafen 10 September. Decision then taken to deliver to Japan by sea, departing 11 November 2004 for port of Gioia Tauro in southern Italy and embarking 9 December on container ship *Dock Express 10*. It arrived in Kobe on 8 January, making its first flight there on 14 January 2005.

COSTS: NT 07-100 EUR8 million, including ground infrastructure (2002); NT 14, 25 per cent higher.

DESIGN FEATURES: Revives original design principles of Count Ferdinand von Zeppelin; first airship in world since 1940 with load-bearing internal structure. Intended as precursor of product line of commercial airships for variety of applications including scientific research, environmental monitoring, TV missions and tourism. Internal 'prism' primary structure modified and optimised from Stuttgart University proposal of 1975 and British patent of 1924; single helium cell; placement of vectored thrust units near CG and also at rear enhances manoeuvrability and control at low speeds, further improving safety and reducing ground crew requirements to three persons, thereby also reducing operating costs. Tailfins in inverted Y configuration.

FLYING CONTROLS: Computer-assisted flight control, propulsion and landing. Dual fly-by-wire flight control system; no mechanical back-up. Elevator or rudder on each tail surface. Engine thrust control (see under Power Plant) in pitch and yaw.

STRUCTURE: Internal primary structure consists of three rows of aluminium tubular longerons, interconnected with triangular carbon fibre frames and cross-braced with Kevlar cables, providing internal prism-shaped structure accounting for only 12 per cent of gross weight; this frame and pressurised envelope are both load-carrying structures to enhance safety factor (airship remains fully manoeuvrable even if internal pressure drops). Envelope, attached continuously to all longerons, is a high-strength, multilayer laminate of polyester and Tedlar; this material has low gas permeability and allows airship to be moored permanently in the open. Air ballonets in lower part of envelope afford protection to cabin and airframe in the event of a hard landing.

LANDING GEAR: Twin landing/ground handling wheels in tandem under gondola and rear of envelope. Airship can be moored to a fixed or mobile mast.

POWER PLANT: Three 149 kW (200 hp) Textron Lycoming IO-360 flat-four engines: one each side of hull above gondola in vectored-thrust propulsion unit, each driving a three-blade, variable-pitch, swivelling (up to 120°) tractor propeller; engine in tailcone drives, via a belt-driven gearbox, a lateral fan (for precise yaw control during low-speed and hovering

manoeuvres) and a vectored propeller used as a pusher in forward flight and for precise pitch control in landing configuration. Combination of thrust vectoring and fuel trim tanks virtually obviates need for ballast management.

ACCOMMODATION: Crew of two, on ergonomically designed flight deck; gondola main cabin accommodates up to 13 passengers on individual seats, with galley, lavatory and wardrobe provision, or equivalent cargo or other payload.

AVIONICS: Radar: Weather radar.

Flight: Dual digital fly-by-wire aerodynamic steering; triple thrust vector steering; modern LCD flight deck avionics, including EFIS, EICAS, radio nav and GPS.

DIMENSIONS, EXTERNAL:	
Envelope: Length overall	75.00 m (246 ft 0¾ in)
Max diameter	14.16 m (46 ft 5½ in)
Fineness ratio	5.3
Max width over propeller ducts	19.50 m (63 ft 11¾ in)
Height overall	17.40 m (57 ft 1 in)

DIMENSIONS, INTERNAL:	
Envelope volume	8,450 m³ (298,400 cu ft)
Ballonet volume (max)	2,200 m³ (77,700 cu ft)
Gondola: Length	10.70 m (35 ft 1¼ in)
Max width	2.25 m (7 ft 4½ in)
Volume	26.0 m³ (918.2 cu ft)

WEIGHTS AND LOADINGS:	
Gondola: structural weight	440 kg (970 lb)
incl equipment and furniture	1,200 kg (2,646 lb)
Max payload	1,900 kg (4,189 lb)
Max T-O weight	10,690 kg (23,567 lb)

PERFORMANCE:	
Max level speed	67 kt (125 km/h; 77 mph)
Cruising speed	62 kt (115 km/h; 71 mph)
Cruising altitude	1,000 m (3,280 ft)
Pressure ceiling	2,600 m (8,530 ft)
Range	486 n miles (900 km; 559 miles)
Endurance at 38 kt (70 km/h; 43 mph):	
with max payload	14 h
with reduced payload	24 h

Hungary

CORVUS

CORVUS AIRCRAFT KFT

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Web: www.corvus-aircraft.com
EXECUTIVE MANAGER: András Voloscsuk

Corvus (Crow), formed in spring 2004, showed the first production Corvus Corone at Aero '05 in Friedrichshafen.

CORVUS CORONE

English name: Carrion Crow
TYPE: Two-seat lightplane; side-by-side ultralight.
PROGRAMME: Designed by Attila Kenéz, Prototype (35-15) first flew in November 2003; further four development aircraft. First production Corone Mk I shown at Aero '05 in April 2005, with 300 flying hours accumulated. Mk II mock-up shown at ILA, Berlin, May 2006.
CUSTOMERS: Three production aircraft under construction by mid-2006. US marketing began in 2006 with appearance at Oshkosh.
DESIGN FEATURES: Intended as spacious, economic, light sport aircraft (LSA/VLA) or ultralight employing high-technology composites and suitable for touring and glider towing. Readily dismantled for storage.
Low, tapered semi-monocoque wing with upturned tips; sweptback fin and low tailplane.
FLYING CONTROLS: Conventional and manual. Frise ailerons, pushrod operated; single-piece elevator, pushrod operated, with flight-adjustable trim tab. Horn-balanced rudder. Slotted flaps.
STRUCTURE: Composites monocoque. Fuselage of Kevlar honeycomb sandwich mixed with carbon fibre and glass fibre, bonded with epoxy resin. Wings assembled from upper and lower load-bearing skins.
LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, spring cantilever mainwheel legs; steerable nosewheel. Wheel fairings throughout.

POWER PLANT: One Jabiru piston engine: 59.7 kW (80 hp) J2200 in ultralight; 89 kW (120 hp) J3300 in VLA. Two-blade Helix fixed-pitch propeller. Wing fuel tanks: capacity 50 litres (13.2 US gallons; 11.0 Imp gallons) in ultralight; 120 litres (31.7 US gallons; 26.4 Imp gallons) in VLA.
ACCOMMODATION: Two persons, with dual controls, beneath single-piece, forward-opening (electrical option) canopy/windscreen. Instrument panel pivots with canopy.
AVIONICS: *Instrumentation:* Analogue or 'glass cockpit' instruments mounted in the base of the opening canopy.
EQUIPMENT: Ballistic parachute standard.
DIMENSIONS, EXTERNAL:
Wing span 9.60 m (31 ft 6 in)
Length overall 6.20 m (20 ft 4 in)
Height overall 2.10 m (6 ft 10¾ in)
DIMENSIONS, INTERNAL:
Cockpit max width 1.16 m (3 ft 9½ in)
WEIGHTS AND LOADINGS:
Weight empty: ultralight 295 kg (650 lb)
VLA 320 kg (705 lb)
Max T-O weight: ultralight 475 kg (1,047 lb)
VLA 600 kg (1,322 lb)
PERFORMANCE:
Never-exceed speed (VNE): ultralight 118 kt (220 km/h; 136 mph)
VLA 143 kt (265 km/h; 164 mph)
Normal cruising speed: ultralight 86 kt (160 km/h; 99 mph)
VLA 103 kt (190 km/h; 118 mph)
Stalling speed, flaps down: ultralight 33 kt (60 km/h; 38 mph)
VLA 36 kt (65 km/h; 41 mph)
Max rate of climb at S/L: ultralight 270 m (886 ft)/min
VLA 480 m (1,575 ft)/min
T-O to 15 m (50 ft): ultralight 290 m (955 ft)
VLA 194 m (640 ft)
Landing from 15 m (50 ft): ultralight 320 m (1,050 ft)
VLA 307 m (1,010 ft)
Max range: ultralight 297 n miles (550 km; 341 miles)
VLA 648 n miles (1,200 km; 745 miles)



Corvus Corone Mk II-UL (Paul Jackson)

1159358

DANEX

DANEX ENGINEERING KFT

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Web: w1.171.telia.com/~u17112535/distributor

Danex builds the EuroCub ultralight which is now marketed in the UK, having been sold in the Nordic countries for over a decade. UK launch in July 2004, but no known sales two years later.

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e-mail: edland@telia.com

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Tel/Fax: (+44 1666) 57 50 83
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Web: www.eurocub.com

DANEX EUROCUB

TYPE: Side-by-side ultralight.
PROGRAMME: Derived from Al Jasman's Canadian-designed Aces High Cuby II (Cuby I being single-seat), now out of production following manufacture of some 20 kits. Swedish consortium acquired production licence in 1989; European prototype, SE-YLM with Rotax 503; others followed with Rotax 582 and Rotax 912. Sales to Denmark, Italy, Norway and Sweden with Rotax 503 and to Finland, Norway and Sweden with Rotax 912, all retaining Cuby II name.
Production transferred in 1994 to Nyiregyháza, Hungary, as Lamco (Light Aircraft Manufacturing Company KFT) EuroCub Mk I with Rotax 912 UL engine and Warp Drive



New-built Eurocub Mk IV, SE-VAY (Paul Jackson)

0589244

IvoProp three-blade propeller, initially retaining 10.27 m (33 ft 8¼ in) wing span, although this reduced and wing endplates added. Mk I became Mk IV upon 30 per cent increase in size of tailplane, plus larger fin and rudder. Lamco became Danex Engineering KFT in 1998.
UK-based EuroCub Ltd formed to market aircraft as factory-built ultralight.
CUSTOMERS: Some 10 European Cuby IIs, two EuroCub 912 ULs, 20 Mk Is and three Mk IVs (plus conversions) produced by mid-2005. Three operated by Swedish Ultralighters from Frolunda, Stockholm.
DESIGN FEATURES: Classic high-wing monoplane with spacious cabin and wide-track landing gear. Constant-chord wing, with endplates, attached to upper longerons and braced to lower longerons by streamlined V struts with vertical intermediate struts. Tailplane braced below with struts and to fin with wires.
Wing section Clark Y (modified).
FLYING CONTROLS: Conventional and manual. Full-span, non-drooping ailerons (no flaps). Horn-balanced rudder and elevators. Flight-adjustable tab in port elevator.

STRUCTURE: Welded 4130 steel tube fuselage covered in doped Ceconite fabric. Wings of 6061-T6 aluminium with aluminium leading-edges and endplates and Ceconite to the rear. Glass fibre engine cowlings. Circular section steel wing bracing struts have streamline wooden fairings to the rear.

LANDING GEAR: Tailwheel type; fixed. Two faired-in side Vs attached to lower longerons, plus half-axes, each with bungee cord shock-absorber, attached to compression frame. Wide track, with tundra tyres. Mainwheels 6.00-6; steerable tailwheel 200x50. Hydraulic brakes. AeroComp SF 1400 floats and amphibious floats optional.

POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL or 73.5 kW (98.6 hp) Rotax 912 ULS flat-four piston engine, driving a Warp Drive ground-adjustable pitch propeller. Fuel capacity 80 litres (21.1 US gallons; 17.6 Imp gallons) in wing tanks; optionally 100 litres (26.4 US gallons; 22.0 Imp gallons) in fuselage tank.

DIMENSIONS, EXTERNAL:

Wing span 9.55 m (31 ft 4 in)

Length overall 6.70 m (21 ft 11¼ in)

Height overall 1.80 m (5 ft 10¾ in)

AREAS:

Wings, gross 15.13 m² (162.9 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: Ultralight 255 kg (562 lb)

Max T-O weight: Ultralight landplane 450 kg (992 lb)

floatplane 490 kg (1,080 lb)

amphibious floatplane 550 kg (1,212 lb)

PERFORMANCE (Rotax 912 ULS at 450 kg; 992 lb):

Normal cruising speed 95 kt (176 km/h; 109 mph)

Stalling speed 32 kt (60 km/h; 37 mph)

T-O run 50 m (165 ft)

Landing run 100 m (330 ft)

Endurance (absolute) 5 h 15 min

g limits +6/-4

HALLEY

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e-mail: apollo@mail.datanet.hu
Web: www.halley.hu
PRESIDENT: Zoltán Molnár

Apollo Aircraft formed at Eger in 1980 by Mr Molnár. First product (1981) was P21 hang glider. Hungarian agent for Rotax engines in 1990. Renamed Halley Kft in 1992. Also produces Jet Star, Delta Jet and Racer GT flex-wings. Had sold more than 1,000 flex-wings by 2003. Workforce 25; factory area 2,500 m² (26,900 sq ft).

HALLEY APOLLO FOX

TYPE: Side-by-side ultralight.

PROGRAMME: Derived from Apollo Classic prototype (HA-YNBA). First flight 1998. Certified in Belgium, Croatia, France, Hungary, Romania and Sweden. In 2003, an Apollo Fox flew from Hungary to Australia without the assistance of a ground support team. US agent, Tampa Bay Aerosport, pursuing SLA approval in 2006.

CUSTOMERS: More than 50 sold by 2003.

COSTS: USD43,500 with Rotax 582 engine; USD56,000 with Rotax 912 ULS; both excluding tax (2006).

DESIGN FEATURES: Built to conform to British BCAR Section S regulations. High, constant-chord wing attached to upper longerons and braced to lower longerons by streamline V struts with vertical intermediate struts. Braced tailplane and sweptback fin. Wings foldable in 10 minutes.

FLYING CONTROLS: Manual. Junkers flaperons, tailplane and rudder.

STRUCTURE: Welded steel/chrome molybdenum fuselage with Ceconite fabric covering. Wing of two aluminium spars with 14 main and 13 auxiliary ribs; Ceconite covering.

LANDING GEAR: Tricycle or tailwheel type; fixed. Two faired-in side Vs with half-axes sprung under centre fuselage. Current nosewheel option has forward inclined leg with combined intermediate brace/compressed rubber shock-absorber and fuselage-mounted spring aluminium cantilever mainwheel legs. Optional mechanical drum or hydraulic disc brakes.

POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 or 73.5 kW (98.6 hp) Rotax 912 ULS flat-four; or 48.0 kW (64.4 hp) Rotax 582 two-cylinder, liquid-cooled piston engine; or 74.6 kW (100 hp) Subaru EA81 flat four, or 59.7 kW (80 hp) Jabiru 2200. Wooden two-blade propeller or ground-adjustable pitch three- or four-blade propellers of glass fibre or carbon fibre. Fuel tanks in wings, combined capacity 70 litres (18.5 US gallons; 15.4 Imp gallons) of which 60 litres (15.9 US gallons; 13.2 Imp gallons) are usable.



Halley Apollo Fox instrument panel 1159288

DIMENSIONS, EXTERNAL:

Wing span 9.15 m (30 ft 0 in)

Length overall 5.80 m (19 ft 0¼ in)

Height overall 1.78 m (5 ft 10 in)

DIMENSIONS, INTERNAL:

Cabin max width 1.10 m (3 ft 7¼ in)

AREAS:

Wings, gross 11.40 m² (122.7 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 285 kg (628 lb)

Max T-O weight 550 kg (1,212 lb)

PERFORMANCE:

Never-exceed (VNE) 108 kt (200 km/h; 124 mph)

Cruising speed with Rotax 912 92 kt (170 km/h; 106 mph)

Stalling speed 35 kt (64 km/h; 40 mph)

Max rate of climb at S/L (solo) 1,325 m (4,347 ft)/min

T-O run 120 m (394 ft)

Landing run 200 m (656 ft)

Range 432 n miles (800 km; 497 miles)

g limits +4/-2



Halley Apollo Fox with aluminium cantilever mainwheel legs 1159287

India

ADA

AERONAUTICAL DEVELOPMENT AGENCY

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The ADA, an autonomous organisation under the Defence Research and Development Organisation (DRDO) of the Indian Ministry of Defence, was created in 1984 to be responsible for design and development of the next-generation Light Combat Aircraft (LCA), which had been authorised in 1983, made its maiden flight in early 2001 and was named Tejas in May 2003; manufacturing partner is Hindustan Aeronautics Ltd (HAL). Several laboratories of the Defence Research and Development Organisation (DRDO) have also contributed to the LCA programme, initial production of which was approved in 2002. Also participating in Indo-Russian Transport Aircraft (IRTA-21), an international programme in the form of the Ilyushin/IAPO/HAL Il-214.

ADA TEJAS

English name: Radiant
TYPE: Multirole fighter.
PROGRAMME:

DEVELOPMENT MILESTONES

Feasibility study began	83
Project definition completed	late 88
Prototype construction started	mid-91
FSED Phase 1 authorised	Jun 93
Rolled out	17 Nov 95
First flight	4 Jan 01
FSED Phase 2 authorised	Nov 01
Initial production approved	Mar 02
Public debut	4 May 03
First supersonic flight	1 Aug 03

Development, as Light Combat Aircraft (LCA), approved by Indian government in 1983 as MiG-21 replacement; Indian Air Force Air Staff Requirement issued October 1985; project definition begun second quarter 1987, completed late 1988, with first flight then predicted for April 1990 and service entry in about 1995. However, due to early slippages, basic design not finalised until 1990; construction by HAL started mid-1991. FSED Phase 1 sanctioned by Indian government in June 1993; Phase 2 authorised November 2001. Aircraft named Tejas (pronounced thay' jus) by Indian Prime Minister at public debut on 4 May 2003.

Programme delays further exacerbated by May 1998 US embargo on supplies and assistance following India's refusal to sign nuclear non-proliferation treaty, necessitating all-Indian completion of development of integration of digital AFCS and some other systems (aircraft is inherently unstable and thus unable to fly without AFCS). However, sanctions lifted on 22 September 2001 and deliveries of air data and initial sensors by BAE Systems Controls (ex-Lockheed Martin) freed to resume in 2003. Development of indigenously developed radar said to be on schedule at that time. Additional USD125 million released in May 1999 to accelerate remaining development.

Phase 1 of flight test programme completed by April 2004 (100th test flight 3 March), in which envelope expanded to M1.4 speed and 11,750 m (38,550 ft) altitude during approximately 200 hours by TD1/2 and PV1; 400th test flight made on 9 May 2005; 500th on 9 March 2006 and 573 (189, 222, 133, 28 and one) flights (by five aircraft) as of 1 December 2006. All aircraft from PV2 onwards are described as being to full production standard.

IOC now expected to be declared with delivery of half a squadron in 2008; full operational clearance by December 2010.

Meanwhile, parallel programme by Gas Turbine Research Establishment (GTRE) at



ADA Tejas prototype TD1

1128959

Bangalore to develop Kaveri turbofan as indigenous power plant has also suffered considerable slippage, resulting in early decision to power prototypes with General Electric F404-GE-F2J3, 11 of which were initially purchased and ground runs of which began 9 April 1998. Bench trials of Kaveri reportedly totalled some 1,200 hours (of 8,000 required) by early 2003, but flight trials (planned to be flown in Russia in Tu-16 testbed) not started by that date. Technological assistance reportedly offered by SNECMA and Eurojet to help achieve new flight test target date of mid-2004, but flight testing still unreported by late 2005, when Indian MoD openly appealed for international participation in completing Kaveri development. Meanwhile, cost of Kaveri programme reassessed by early 2005 at INR28 billion (USD640 million). ADA revealed in February 2006 award of contract to SNECMA for assistance in engine programme, plus plans to deliver one to Russia for flight testing from June to September 2006, now to take place on an Il-76 testbed instead of Tu-16. Test engine then to be returned for installation in PV1, requiring modification of intakes and fuselage contours. Re-engined PV1 said to begin flight testing "well into" 2007.

To offset delays in Kaveri programme, at least first eight and next 20 production aircraft now to be fitted with F404, in addition to prototypes. Further 17 F404s ordered in February 2004 (for 2006 delivery) and 40 more in 2005; former batch will be of uprated F404-GE-IN20 version and power first eight limited production aircraft and two naval prototypes.

CURRENT VERSIONS (specific): **TD1:** First prototype (TD: technology demonstrator); IAF serial number KH2001. Single-seat, F404-F2J3 engine. Rolled out 17 November 1995, then nine months behind already much-revised schedule. Several subsequent postponements of new (June 1996) target date for first flight, this eventually taking place 4 January 2001. Manufacturer's initial flight tests completed with 12th sortie on 2 June 2001, reaching 8,000 m (26,250 ft) altitude, 18° AoA and M0.71 speed. First supersonic flight targeted for January 2002 and eventually achieved (M1.08) on 1 August 2003; 55 flights by 6 November 2003, 115 by 4 January 2005, 172 by 10 February 2006 and 189 by 1 December 2006.

TD2: Rolled out (KH2002) 14 August 1998. Single-seat, F404-F2J3 engine. Scheduled to fly September 2001, but not achieved until 6 June 2002; 64 flights by 6 November 2003, 131 by 4 January 2005, 217 by 12 April 2006 and 222 by 1 December 2006. Marginally lighter empty weight than TD1, increased usable fuel and Indian-developed HUD.

PV1: Third development aircraft (PV: prototype vehicle). Single-seat, F404-F2J3 engine. Targeted to fly 2002, but not rolled out (KH2003) until 4 May 2003, making maiden flight 25 November 2003; 75 flights by 4 January 2005, 130 by 5 June 2006 and 133 by 1 December 2006. Reportedly some 746 kg (1,645 lb) lighter than TD1 and 2 due to greater use of composites.

PV2: Fourth development aircraft; under construction 2003; 'nearing completion' March 2004. Maiden flight (KH2004) targeted for February 2005; achieved 1 December 2005; 13 flights by 2 June 2006 and 28 by 1 December 2006. Single-seat, F404-F2J3 engine. Scheduled as first to have indigenous radar, after this completes its flight test in a HAL HS 748 testbed.

PV3: Fifth development aircraft (KH2005). Single-seat, F404-F2J3 engine. First flight targeted for October 2005, but not achieved until 1 December 2006.

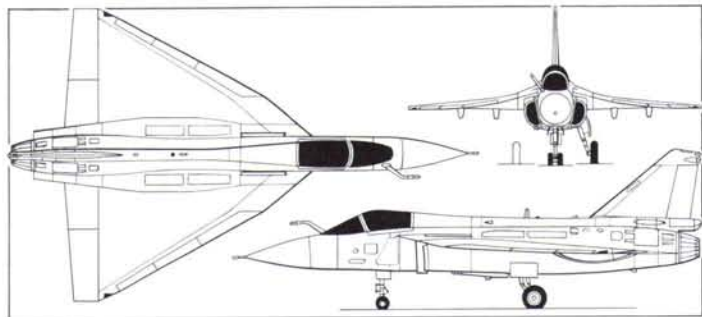
PV4: Sixth development aircraft. Single-seat, F404-F2J3 engine.

PV5: Final Indian Air Force development aircraft. Two-seat operational trainer, F404-F2J3 engine. Some commonality with naval variant.



Tejas prototype PV2, first flown 1 December 2005

1128958



ADA Tejas light combat aircraft (Mike Keep)

0110517

NP1: First Indian Navy prototype. Two-seat, F404-IN20 engine. Landing gear designed for sink rate of up to 7.5 m (24.6 ft)/s compared with about 3.2 m (10.5 ft)/s of land variants. First flight targeted for 2007. Max T-O weight 12,500 kg (27,557 lb); external stores load reduced to 3,000 kg (6,614 lb); max carrier landing weight 9,500 kg (20,944 lb).

NP2: Second Indian Navy prototype. Single-seat, F404-IN20 engine.

CURRENT VERSIONS (general): **Tejas:** Single-seat version for Indian Air Force. As described. **Tejas Trainer:** Tandem two-seat operational trainer; PV-5 prototype under development. Maiden flight reportedly targeted for March 2007.

Tejas Navy: Carrierborne version; 4° drooped nose, new centre fuselage, arrestor hook, long-stroke landing gear with twin nosewheels, retractable canards and movable vortex controls ('levcons') at the wingroot leading-edge. Design approved early 1999; development approved by Indian government in mid-2002; full scale engineering development started March 2003. Designed to operate from carrier deck with 14° ski-jump after 195 m (640 ft) deck run.

CUSTOMERS: Indian Air Force (requirement for 200 single-seat and 20 trainers); Indian Navy may order up to 40 single-seaters. First eight for IAF approved in MoU March 2002; production by HAL at Bangalore. Initial contract for 20 anticipated in 2005, with option for further 20. These 40 expected to comprise 32 single- and eight two-seaters.

COSTS: Phase 1 (TD1 and TD2) costs, including engine, estimated at approximately INR30 billion (USD675 million) by late 2000. Estimated unit cost, based on 220 production total, US\$D17 million to US\$D20 million (2001). Revised estimate for first 20 production aircraft quoted as INR20 billion (USD444.4 million) (2005).

DESIGN FEATURES: Tail-less delta planform with relaxed static stability; shoulder-mounted delta wings with compound sweep on leading-edges; large twist from inboard to outboard leading-edges; wing-shielded, side-mounted, fixed-geometry Y-duct air intakes. Advanced materials for minimum structural weight; fly-by-wire and HOTAS controls; high agility; supersonic at all altitudes; wide range of external stores.

FLYING CONTROLS: Hydraulically actuated two-segment trailing-edge elevons and three-section leading-edge slats; vortex-shedding inboard leading-edges with inboard slats to form vortices over wingroot and fin; airbrake in top of fuselage each side of vertical fin; these and rudder also actuated hydraulically. Levcon (leading-edge vortex controller) at wingroot of naval version as secondary control surface to aid low-speed deck landing.

STRUCTURE: Advanced materials include aluminium-lithium alloy, carbon composites and titanium alloys; CFRP wings (including elevons), fin (except GFRP tip) and rudder; Kevlar radome. Wings manufactured with one-piece CFRP top and bottom skins, bolted on to wing box; majority of spars and ribs in composites. Fin, rudder, elevons, airbrakes and landing gear doors embody co-cured, co-bonded techniques. Carbon fibre composites to be increased from 30 per cent of airframe weight in TD1/2 to 42 per cent in PVs, with corresponding reduction of aluminium alloys from 57 to 43 per cent.

Hindustan Aeronautics (HAL) responsible for fuselage, communications system, electrical system, mechanical system LRUs and utility systems management; Aeronautical Development Establishment (ADE) flight control system, cockpit displays and display processors; National Aerospace Laboratories (NAL) responsible for development of fin and fabrication of rudder.

LANDING GEAR: Hydraulically retractable tricycle type. Single inward-retracting mainwheels; twin-wheel forward-retracting and steerable nose unit. DRDL carbon disc brakes; computer-controlled brake management system. ADRDE brake-chute in fairing at base of rudder. Sink rate of naval version 7.5 m (24.6 ft)/s.

POWER PLANT: TD1, TD2 and PV-1 to -5: One 80.1 kN (18,000 lb st) General Electric F404-GE-F2J3 afterburning turbofan.

NP-1, NP-2 and initial production aircraft: One 83.2 kN (18,700 lb st) General Electric F404-GE-IN20 afterburning turbofan, with FADEC.

Later production aircraft: Indian GTRE GTX-35VS Kaveri turbofan (52.0 kN; 11,700 lb st dry, 80.5 kN; 18,100 lb st with afterburning), with digital engine control unit (KADECU), under development. Multi-axis thrust vectoring nozzle planned.

Internal fuel in wing and fuselage integral tanks. Fixed in-flight refuelling probe on starboard side of front fuselage. Provision for up to three 1,200 or five 800 litre (317 or 211 US gallon; 264 or 176 Imp gallon) external fuel tanks on wing inboard, mid-board and underfuselage stations.

ACCOMMODATION: Pilot only, on Martin-Baker zero/zero ejection seat. Canopy opens sideways to starboard. Development will include two-seat training version.

SYSTEMS: Hydraulic system (by HAL) for powered flying controls, brakes and landing gear; electrical system for fly-by-wire and avionics power supply; Spectrum Infotech environmental control system for cockpit, radar and fuel tanks; lox system; HAL GTSU-110 gas turbine starter unit; aircraft-mounted accessory gearbox; USMS for aircraft utilities systems management. All utility systems (fuel, hydraulic, environmental control, electrical and brake management) are controlled by microprocessors.

AVIONICS (PRODUCTION VERSION): Avionics systems have capability to monitor health of main utility systems.

Comms: HAL V/UHF (with built-in ECCM) and standby UHF radios and audio management unit; HAL air-to-air/air-to-ground secure datalink; HAL IFF transponder/interrogator.

Radar: Electronics Research and Development Establishment (ERDE)/HAL multimode radar with multitarget search and track-while-scan and ground mapping functions; coherent pulse Doppler system, with look-up/look-down modes, Doppler beam-sharpening and moving target indication.

Flight: Quadruplex digital fly-by-wire AFCS. RLG-based INS; provision for GPS/INS; HAL RAM 1701A radio altimeter.

Instrumentation: NVG-compatible 'glass cockpit'; two Bharat Electronics active matrix, reconfigurable 76 × 76 mm (3 × 3 in) colour LCD MFDs; Bharat Electronics (CSIO-designed) collimated HUD; dedicated LCD 'get-you-home' panel; LCD multifunction keyboard.

Mission: Three multiplexed MIL-STD-1553B digital databusses; 32-bit, Power PC/VME64-based mission computer operating in Ada, backed up by a second, equally powerful computer;IRST; laser range-finder/designator pod. Provision for reconnaissance, EW or other sensor pods. Helmet-mounted display/sight.

Self-defence: EW suite, by Advanced Systems Integration and Evaluation Organisation (ASIEO), includes radar warning receiver, self-protection jammer, laser warning system, missile approach warning system, countermeasures dispensing system and chaff/flare dispenser.

ARMAMENT: GSh-23 twin-barrel 23 mm gun with 220 rounds in blister beneath starboard engine intake trunk. Eight external stores stations (three under each wing, one on fuselage centreline and one beneath port intake trunk) for wide range of short/medium-range air-to-air missiles, PGMs, air-to-surface (including anti-ship) missiles, targeting or ECM pod, unguided rockets, conventional and retarded bombs, and cluster bomb dispensers. Indigenous Astra active radar-guided ASM under development by DRDL. Underwing stations stressed for loads of 1,200 kg (2,646 lb) inboard, 800 kg (1,764 lb) centre and 150 kg (331 lb) outboard; centreline station also 1,200 kg; port intake trunk station can carry 200 kg (441 lb) pod (FLIR,IRST, laser designator or reconnaissance). All except outboard underwing stations are wet for carriage of drop tanks.

DIMENSIONS, EXTERNAL:

Wing span	8.20 m (26 ft 10¾ in)
Wing aspect ratio	1.8
Length overall	13.20 m (43 ft 3¾ in)
Height overall	4.40 m (14 ft 5¼ in)
Wheel track	2.20 m (7 ft 2½ in)
Wheelbase	4.34 m (14 ft 2¾ in)

AREAS:

Wings, gross	approx 38.40 m ² (413.3 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	approx 5,500 kg (12,125 lb)
Max external stores load	more than 4,000 kg (8,818 lb)
T-O weight (clean)	approx 8,500 kg (18,740 lb)
Wing loading (clean)	approx 221.4 kg/m ² (45.35 lb/sq ft)
Power loading (TD1 and 2, clean)	106 kg/kN (1.04 lb/lb st)

PERFORMANCE (estimated):

Max level speed at altitude	M1.8
Service ceiling	above 15,240 m (50,000 ft)
g limits	+9/-3.5

ADA MEDIUM COMBAT AIRCRAFT (MCA)

The DRDO is studying an advanced version of the Tejas under the above designation, as a potential replacement for Indian Air Force Jaguars and Mirage 2000s from about 2010. Conceptual design has begun, and specifications were continuing to be defined by the Indian Air Force in 2005-06. The single-seat, tail-less delta MCA is intended to embody stealth technology, be powered by two non-afterburning variants of the GTRE Kaveri turbofan with thrust vectoring, carry laser-guided weapons and have a greater range than the Tejas. Other design features are planned to include the adoption of radar-absorbent materials; twin outward-canted tailfins; and overwing external fuel tanks. Design and development costs were provisionally estimated at US\$2.3 billion in 1996 dollars.

WEIGHTS AND LOADINGS(approx):

T-O weight: clean	12,000 kg (26,455 lb)
max	18,000 kg (39,685 lb)

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HEAD OF CCADD AND SARAS PROJECT MANAGER: Dr K Yegna Narayan

Design and development of the Saras twin-turboprop business and commuter transport is nearing fruition as an Indian programme, having previously appeared in the International section under the Myasishchev/NAL heading and latterly under that of the Indian National Aerospace Laboratories (NAL). It has received Rs 1.58 billion (US\$33 million) funding from various Indian government agencies and is currently under the leadership of CSIR, which has created the Centre of Civil Aircraft Design and Development (CCADD) to act as the nodal agency to monitor and manage the programme. Many Indian public and private sector industries are participating in the venture, with manufacture of production components being carried out in 35 work centres across the country. Final assembly will be by NAL.

CSIR SARAS

English name: Crane

TYPE: Twin-turboprop transport.

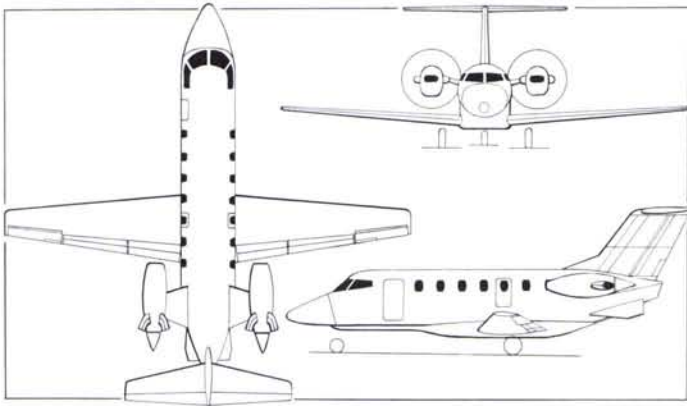
PROGRAMME: Originated as six/nine-passenger light transport shown in model form at Moscow Aerospace '90 exhibition; revised design announced by Myasishchev 1993, with name Delphin; India had comparable project; general agreement concluded 1993 to combine Myasishchev and Indian programmes. Russian version being known as M-102 Duet and Indian version as Saras (species of Indian crane). Full-scale mockup shown at 1993 and 1995 Moscow Air Shows. Prototype construction (two in Russia, one in India originally) planned to begin in September 1994, but Indian share of private venture capital not secured until early 1996. Detailed engineering began in April 1996 following finalisation of design late in previous year; however, in 1997 Myasishchev was proceeding with unilateral development of the similar M-202, yet by 2001, was again promoting M-102 version; neither has progressed to the prototype stage in Russia. In early November 2001, Russia and India signed a protocol on construction of the M-102/Saras.

India elected to continue with the Saras as a national programme, although some collaboration with the former Russian partner was not ruled out. Government secured private backing of Taneja Aerospace and Kumaran Industries, plus financial support from the Indian Technology Development Board. Hindustan Aeronautics Ltd also became a



CSIR Saras in flight (Patrick Allen)

1136946



CSIR Saras twin-turboprop transport (James Goulding)

0130859

major partner in the development programme and to build production aircraft at Nasik. Release of further government funding in mid-1999 enabled work to begin on manufacture (by HAL) of two flying prototypes and a structural test airframe. First prototype (VT-XSD) reported in February 2001 to be 80 per cent complete, with first flight then expected by end of 2001, but in following month, programme management board called for "rigorous weight control exercise". Roll-out 4 February 2003; first engine run conducted 30 October 2003; first flight 29 May 2004, followed by second flight on 7 June 2003. 'Inaugural' flight of 22 August 2004 was seventh sortie, performed for VIPs. Flew 50th sortie on 28 April 2006. Registration VT-XRM reserved for second prototype, scheduled to fly during 2005, but unreported, and to join the 500-hour flight test programme leading to FAR Pt 25 certification in 2007, and first customer deliveries in 2008.

CURRENT VERSIONS: **Saras:** Initial variant, as described.

Saras-S: Stretched 22- to 25-seat version, first publicly revealed in model form at Asian Aerospace 2004 in Singapore in February 2004 and expected to become standard production model. Provisional data includes: maximum T-O weight 7,900 kg (17,416 lb); maximum fuel 900 kg (1,984 lb); maximum speed at 9,140 m (30,000 ft) 249 kt (462 km/h; 287 mph); cruising speed 239 kt (442 km/h; 275 mph); T-O run 880 m (2,887 ft); service ceiling 9,140 m (30,000 ft); max rate of climb at S/L 826 m (2,710 ft)/min; range with max payload at FL300 540 n miles (1,000 km; 621 miles).

CUSTOMERS: At least 250 Indian orders forecast over 15 years. Indian Air Force has initial requirement for six, to replace Dornier 228s, by 2005; Indian Coast Guard also considering Saras as Dornier 228 replacement.

COSTS: Design and development cost quoted in February 1996 as USD40 million. Late in 1996, cost re-estimated as USD60 million, including flight test phase. Indian government approved INR1.3 billion (USD30 million) in June 1999 to enable prototype manufacture to begin. Estimated unit price USD3.75 million (2001).

DESIGN FEATURES: Suitable for operations in hot-and-high conditions (typically, airfield at 2,000 m; 6,560 ft, at up to 45°C), and from semi-prepared runways. Unconventional twin pusher propeller configuration. High aspect ratio, low-mounted wings, with straight taper; pressurised circular-section fuselage; T tailplane on sweptback fin; engines pylon-mounted each side of rear fuselage.

Wing section GA(W)-2 (modified); leading-edge sweep 5°; thickness/chord ratio 15 per cent; 4° dihedral; 2° incidence; 2° twist.

FLYING CONTROLS: Conventional and manual. Tabs in all control surfaces; electrically operated pitch, roll and yaw trim; yaw damper; spoilers and 25 per cent chord, single-slotted Fowler flaps; dual-channel three-axis autopilot. Highly swept ventral fins provide nose-down pitching moment at high AoA.

STRUCTURE: Mixed construction of aluminium alloy (fuselage, engine pylons and fixed portion of wing) and composites (nosecone, wing/body fairing, wing moving surfaces and tips); designed for 30,000 hour life; fail-safe philosophy for all primary structures and major attachments; incorporates damage tolerance features. Two-spar wing with integrally milled skin riveted to stringers; two-spar flaps with honeycomb sandwich filler; single-spar ailerons with honeycomb filler; single-piece, two-spar metal tailplane and three-spar metal fin.

LANDING GEAR: Hydraulically retractable tricycle type, with single mainwheels and single steerable (±53°) nose unit. Mainwheels retract inward into wingroot fairings, nosewheel forward. Oleo-pneumatic shock-absorbers. Mainwheels 26x8.75, pressure 5.52 bar (80 lb/sq in); nosewheel 17.5x6.3, pressure 3.79 bar (55 lb/sq in); air-cooled carbon brakes. Minimum turning radius 8.10 m (26 ft 7 in) at nosewheel.

POWER PLANT: Two 634 kW (850 shp) Pratt & Whitney Canada PT6A-66 turboprops, pylon-mounted on sides of rear fuselage; Hartzell five-blade, constant-speed pusher propellers, rotating in opposite directions. Integral fuel tank in each wing, combined capacity 1,608 litres (425 US gallons; 354 Imp gallons), of which 1,595 litres (421 US

gallons; 351 Imp gallons) are usable. Gravity refuelling point in port wing upper surface; optional single-point pressure refuelling point at starboard wingroot.

ACCOMMODATION: Two-person flight deck with dual controls, but to be certified also for one-pilot operation. Alternative layouts for 14 economy class passengers in single seats at 76 cm (30 in) pitch, with centre aisle, rear lavatory and total of 1.1 m³ (39 cu ft) for baggage in forward and rear compartments; or 18 passengers in commuter layout. Typical executive interior could have eight seats, tables, wardrobe, baggage compartment, galley and lavatory. Ambulance version capable of carrying six stretchers, with seats for two medical attendants, medical supplies storage, baggage compartment and lavatory. Various passenger/cargo arrangements or special mission interiors optional in combi version. Door at front on port side, hinged downward, with integral airstairs; overwing Type III emergency exit on each side. Baggage compartment door on port side of tailcone.

SYSTEMS: Bootstrap environmental control system and pneumatic cabin pressure control system; cabin pressure differential 0.45 bar (6.5 lb/sq in). Hydraulic system (pressure 207 bar; 3,000 lb/sq in) for landing gear actuation, brakes and nosewheel steering; 4 litres (1.06 US gallons; 1.27 Imp gallons)/min electrically powered hydraulic pump; pneumatic system for emergency lowering of landing gear.

Primary electrical power is 28 V DC, supplied by two 12 kW starter/generators; 43 Ah Ni/Cd battery provides emergency power for essential loads for approximately 30 minutes, including three engine restarts. Two solid-state inverters supply 115/26/5 V AC power at 400 Hz for instrumentation; AC power for anti-icing and windscreen heating obtained via alternators. Emergency oxygen system for crew and passengers (two 1,400 litre; 49.4 cu ft bottles), plus two 122 litre (4.3 cu ft) portable bottles and masks for first aid. Engine fire and cabin smoke detection systems. Halon fire extinguishing system. De-icing boots on wing leading-edge nacelle intakes.

AVIONICS: Integrated digital system (ARINC 429 compatible).

Comms: VHF (two), optional HF, intercom/PA system, TCAS II transponder and CVR. **Radar:** Weather radar.

Flight: Autopilot (dual-channel, three-axis), ADF, VOR/ILS, marker beacon receiver, DME, radar altimeter, air data sensor and computer, AHRS, flight control computer and flight director standard; GPS, satcom, Selcal and flight management system optional.

Instrumentation: Four-tube EFIS; 'return home' standby instrumentation.

DIMENSIONS, EXTERNAL:

Wing span	14.70 m (48 ft 2 3/4 in)
Wing chord: at c/l	2.65 m (8 ft 8 1/4 in)
at tip	0.85 m (2 ft 9 1/2 in)
Wing aspect ratio	8.4
Length overall	15.02 m (49 ft 3 3/4 in)
Fuselage: Length	13.90 m (45 ft 7 1/4 in)
Max diameter	1.95 m (6 ft 4 3/4 in)
Height overall	5.20 m (17 ft 0 3/4 in)
Tailplane span	6.09 m (19 ft 11 1/4 in)
Wheel track	3.20 m (10 ft 6 in)
Wheelbase	6.465 m (21 ft 2 1/2 in)
Propeller diameter	2.16 m (7 ft 1 in)
Propeller ground clearance	1.30 m (4 ft 3 1/4 in)
Distance between propeller centres	3.89 m (12 ft 9 in)
Passenger door (fwd, port): Height	1.48 m (4 ft 10 1/4 in)
Width	0.75 m (2 ft 5 1/2 in)

DIMENSIONS, INTERNAL:

Cabin: Length	7.74 m (25 ft 4 3/4 in)
Max width	1.80 m (5 ft 10 3/4 in)
Aisle width at floor	0.54 m (1 ft 9 1/4 in)
Max height	1.72 m (5 ft 7 3/4 in)
Floor area	7.08 m ² (76.2 sq ft)
Volume	21.3 m ³ (752 cu ft)
Baggage hold volume: fwd, stbd	0.64 m ³ (22.6 cu ft)
rear, port	0.46 m ³ (16.2 cu ft)

AREAS:

Wings, gross	25.70 m ² (276.6 sq ft)
Ailerons (total)	1.27 m ² (13.71 sq ft)
Trailing-edge flaps (total)	3.99 m ² (42.93 sq ft)
Spoilers (total)	0.65 m ² (7.00 sq ft)
Fin	5.70 m ² (61.40 sq ft)
Rudder, incl tab	1.81 m ² (19.45 sq ft)
Tailplane	7.00 m ² (75.35 sq ft)
Elevators, incl tabs	2.05 m ² (22.07 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	4,116 kg (9,074 lb)
Max fuel weight	1,326 kg (2,923 lb)
Max payload	1,232 kg (2,716 lb)
Max T-O and landing weight	6,100 kg (13,448 lb)
Max zero-fuel weight	5,348 kg (11,790 lb)
Max wing loading	237.4 kg/m ² (48.61 lb/sq ft)
Max power loading	4.81 kg/kW (7.91 lb/shp)

PERFORMANCE (estimated):

Never-exceed speed (V _{NE})	372 kt (690 km/h; 428 mph)
Max level speed at FL250	283 kt (524 km/h; 326 mph)
Econ cruising speed at FL250	216 kt (400 km/h; 249 mph)
Stalling speed at S/L, power off:	
flaps up	96 kt (178 km/h; 111 mph)
flaps down	78 kt (145 km/h; 90 mph)
Max rate of climb at S/L	700 m (2,297 ft)/min
Rate of climb at S/L, OEI	130 m (427 ft)/min
Max certified altitude	9,100 m (29,860 ft)
Service ceiling	11,000 m (36,090 ft)
Service ceiling, OEI	6,000 m (19,680 ft)
T-O run	720 m (2,362 ft)
T-O field length	1,000 m (3,280 ft)
Landing field length	1,200 m (3,937 ft)
Landing run	720 m (2,362 ft)
Runway LCN	10
Range, IFR reserves:	
with 8 passengers	756 n miles (1,400 km; 870 miles)
with 14 passengers	216 n miles (400 km; 248 miles)
self-ferry	1,038 n miles (1,924 km; 1,195 miles)
Endurance	5 h

HAL

HINDUSTAN AERONAUTICS LIMITED

CORPORATE OFFICE: PO Box 5150, 15/1 Cubbon Road, Bangalore 560 001
Tel: (+91 80) 286 46 36/7 and 286 46 39/43
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e-mail: marketing@hal-india.com
Web: www.hal-india.com
CHAIRMAN: Ashok K Baweja
EXECUTIVE DIRECTOR, PLANNING: B K Banerjee
DIRECTOR, CORPORATE PLANNING AND MARKETING: M Fakrudin
GENERAL MANAGER, MARKETING: Air Cdre (Retd) B Banerjee
CHIEF OF MEDIA COMMUNICATIONS: Anantha Krishnan

Hindustan Aircraft (Pvt) Ltd, established at Bangalore in 1940, was taken over by the Indian Ministry of Industry and Supplies in 1945, transferring to Ministry of Defence control in 1951. In August 1963, Hindustan Aeronautics Ltd (HAL) was incorporated as a wholly government-owned entity, adopting its present existence upon merging (with no change of name) with Aeronautics India Ltd (AIL) on 1 October 1964. HAL has manufactured more than 3,500 aircraft (12 types of in-house design and 13 types by licensed manufacture) and 3,540 aero-engines. It has 14 manufacturing divisions at eight locations (seven at Bangalore, one each at Nasik, Koraput, Hyderabad, Barrackpore, Kanpur, Lucknow and Korwa), plus Design and Development Complex: nine R&D centres located with manufacturing divisions; all divisions have ISO 9000, 9001 and 9002 accreditation. Workforce 30,000 in late 2004. Hyderabad Division manufactures avionics for all aircraft produced by HAL, plus air route surveillance and precision approach radars; Lucknow Division produces instruments and other accessories under licence from manufacturers in France, Russia and the UK; Korwa manufactures inertial navigation and nav/attack systems.

Former Multirole Transport Aircraft (MTA) project now an international joint venture (IRTA-21: Indo-Russian Transport Aircraft, 21st century) with Ilyushin and IAP of Russian Federation.

Turnover during 2004-05 totalled INR4.425 billion; net profit during this period was INR0.63 billion, representing percentage increases over 2003-04 of 16 and 5 respectively.

Major elements of HAL are:

DESIGN AND DEVELOPMENT COMPLEX Follows this entry
BANGALORE COMPLEX Follows Design and Development Complex
TRANSPORT AIRCRAFT DIVISION Follows Bangalore Complex
MIG COMPLEX Follows Transport Aircraft Division
ACCESSORIES COMPLEX
PO Box 215, Lucknow 226 016
Tel: (+91 522) 34 03 27
Fax: (+91 522) 34 03 42
MANAGING DIRECTOR: K Umamaheshwar

Comprises Lucknow (Accessories), Hyderabad (Avionics) and Korwa (Avionics) Divisions.

DESIGN AND DEVELOPMENT COMPLEX

PO Box 1789, Bangalore 560 017
Tel: (+91 80) 526 34 57
Fax: (+91 80) 526 30 96
Telex: 845 8083
DIRECTORS:
M S Nadgir (Design and Development)
Yogesh Kumar (LCA)
GENERAL MANAGERS:
Fateh Singh (ARDC)
N H Venkatesh (RWRDC)

HAL currently has nine Research and Design (R&D) Centres, including one each for fixed-wing aircraft (ARDC) and rotary-wing (RWRDC) programmes. Former's main programmes are LCA Tejas (managed by ADA) and HJT-36 Sitara; latter concerned mainly with Dhruv ALH. Transport Aircraft R&D Centre was responsible for developing oversize cabin door, integration of Super Marec radar, gun pod, IR/UV scanner and flight data recorder for HAL-built Dornier 228 programme. Earlier designs have included HT-2, Pushpak, Krishak, Basant, Marut, Kiran, Deepak and HTT-34. Jet trainer successor to Kiran was revealed as HJT-36 in 1998; flight testing began in 2003. Complex had workforce of 1,901 in 2003.

HAL LCH

TYPE: Multirole medium helicopter.
PROGRAMME: Derivative of Dhruv (which see); displayed in model form at Paris Air Show, June 2001 as LAH (light attack helicopter) proposal, but was restyled LCH, signifying light



Artist's impression of HAL Light Combat Helicopter 0576665

combat. Original slimmed-down 'gunship' fuselage now discarded and basic Dhruv airframe retained except for forward fuselage modified to tandem crew seating. Officially launched 5 February 2003 and replaces earlier LOH programme, which now to be met by foreign design. LCH scheduled to fly within two years of government go-ahead. Primary intention is to replace Indian Army Cheetah and Chetak, but now being developed for multirole applications. Prospects improved by 2004 decision to reduce planned buy of 198 foreign combat helicopters to only 35, with LCH making up shortfall. First flight believed targeted for 2007.

COSTS: INR300 million earmarked for design and development (2003).
DESIGN FEATURES: Generally as for Dhruv except for modified nose section with tandem crew seating. Four-blade hingeless main rotor with swept blade tips. Intended for anti-tank, close air support, air-to-air combat and scout roles. All weather, high-altitude operability.
STRUCTURE: Extensive use of composites to reduce radar signature.
LANDING GEAR: Non-retractable and crashworthy tricycle type.
POWER PLANT: Two 895 kW (1,200 shp) Turbomeca/HAL TM333-2C2 Ardenid 1H turboshafts (Indian name Shakti) with FADEC, derated to 798 kW (1,070 shp). Crashworthy fuel system.
ACCOMMODATION: Crew of two in tandem; ergonomic cockpit.
SYSTEMS: Four-axis autostabilisation system; anti-resonance isolation system (ARIS). Dual-redundant electrical and hydraulic systems as for Dhruv.
AVIONICS: Radar: Requirement for maritime/overland surveillance radar.
Flight: Digital AFCS and nav/com as for Dhruv.
Instrumentation: Dual night attack MFDs in each cockpit.
Mission: FLIR, TV and laser range-finder/designator; helmet-mounted sights.
Self-defence: Radar and laser warning receivers; MAWS; chaff/flare dispenser.
ARMAMENT: Undernose 20 mm cannon. Stub-wing hardpoints for ASMs, ATMs, AAMs or rocket launchers.
DIMENSIONS, EXTERNAL:
Main rotor diameter 13.20 m (43 ft 3 3/4 in)
Length: fuselage 13.94 m (45 ft 8 3/4 in)
overall, rotors turning 15.86 m (52 ft 0 1/2 in)
Height to top of rotor head 5.27 m (17 ft 3 1/2 in)
Stub-wing span 4.43 m (14 ft 6 1/2 in)
Wheel track 2.50 m (8 ft 2 1/2 in)
WEIGHTS AND LOADINGS:
Max T-O weight 5,500 kg (12,125 lb) class
PERFORMANCE (estimated):
Never-exceed speed (VNE) 178 kt (330 km/h; 205 mph)
Max cruising speed 151 kt (280 km/h; 174 mph)
Service ceiling 6,500 m (21,320 ft)
Range with standard fuel 378 n miles (700 km; 435 miles)

HAL HJT-36 SITARA

English name: Star
TYPE: Basic jet trainer/light attack jet.
PROGRAMME:

DEVELOPMENT MILESTONES

Design started	97
Revealed	Feb 98
Mockup displayed	Dec 98
Development contract awarded	Jul 99
Production approval	Jan 01
First flight	7 Mar 03
Official first flight	21 Mar 03

Revealed at Singapore Air Show, February 1998; design started 1997. Conceived as IJT (Intermediate Jet Trainer) successor to IAF HJT-16 Kiran second-stage pilot trainer. Mockup, with Thales (Sextant) avionics suite, exhibited at Air India Show in December 1998, differed considerably in appearance from general arrangement released at Singapore. Indian government contract valued at USD42 million awarded in July 1999, covering completion, flight test (4,500 hours) and certification of prototypes; avionics contract placed June 2001. First metal cut July 2001; structural assembly began January 2002; systems integration started December 2002; roll-out 26 December 2002; first taxi tests February 2003. Maiden flight of first prototype (S3466) 7 March 2003; 'inaugural' (official) first flight 21 March 2003 was seventh sortie; about 50 flights by 1 February 2004; second prototype (S3474), with full 'glass cockpit' and digital avionics, flew on 26 March 2004; about 150 flights by first two prototypes by June 2005. Second prototype shown at Aero India, February 2005; international debut at Paris, June 2005.

Surprise announcement by HAL in second quarter 2004 indicated that Larzac power plant to be replaced for production aircraft by still-in-development Saturn AL-55 turbofan, produced by Ufa Engine Building Association (UMPO). Sitara production start will be correspondingly delayed (from late 2004/early 2005), since delivery of first batch of Russian engines not expected before 2006 at the earliest. Indo-Russian agreement for licensed manufacture of AL-551 signed 16 August 2005; initially, HAL will build 250 engines, with options for up to 750 more. Will also power HJT-39 if that programme goes ahead.

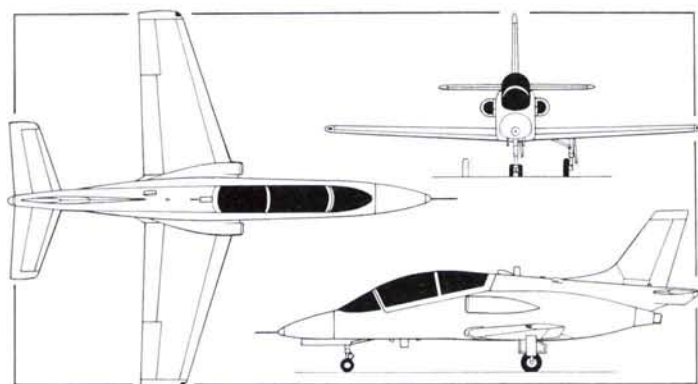
CUSTOMERS: Indian Air Force and Navy as replacement for existing fleet of approximately 170 Kirans from about 2005. Government provisional approval for 211 awarded in January 2001, 187 for Indian Air Force and 24 for Indian Navy; total production expected to be between 210 and 250. Announced 6 February 2003 that initial order would be 16 for IAF; these to be preceded by LSP (limited series production) batch of 12.

COSTS: Development cost INR4.67 billion (2005).
DESIGN FEATURES: Capable of high-speed training, but with simple handling at low speeds; cockpit layout compatible with current combat aircraft; some 25 per cent of LRUs are common with ADA Tejas. Conventional, low-wing CAD/CAM design (HAL's first) with moderate (18°) wing leading-edge sweepback and 2° dihedral. NACA 64-series aerofoil (t/c ratio 15 per cent at root, 12 per cent at tip).
FLYING CONTROLS: Conventional. Manually operated ailerons and rudder with electric trim; electrically actuated, horn-balanced elevators. Flaps. Large perforated airbrake under rear fuselage.
STRUCTURE: Light alloy and composites. Intended fatigue life of more than 7,500 hours, extendable to 10,000 hours.
LANDING GEAR: Hydraulically retractable tricycle type. Inward-retracting main units, forward-retracting twin nosewheels.
POWER PLANT: Prototypes powered by one 14.12 kN (3,175 lb st) SNECMA Larzac 04-H20 non-afterburning turbofan in rear fuselage, fed by bifurcated air intake. Saturn/UMPO 21.6 kN (4,850 lb st) AL-551 non-afterburning turbofan selected in April 2004 for production aircraft; to be manufactured under licence by HAL. Fuel tanks in fuselage and wings. Usable fuel capacity 1,150 litres (304 US gallons; 253 Imp gallons).



HAL HJT-36 Sitara second prototype (Paul Jackson)

1158006



Provisional general arrangement of the HAL HJT-36 jet trainer (Michael Badrocke)

ACCOMMODATION: Crew of two in tandem, on Zvezda K-36LT lightweight zero/zero ejection seats; rear (instructor's) seat raised. One-piece canopy opens sideways to starboard. Forward vision over nose -8° .

SYSTEMS: Hydraulic system for landing gear actuation and wheel brakes. Electrical system powered by 9 kW engine-driven starter/generator and two 43 Ah Ni/Cd batteries. Gaseous oxygen system.

AVIONICS: Smiths Aerospace integrated system, with units supplied by French, German and Indian manufacturers, comprising dual V/UHF comms, open systems architecture mission computer, HUD (Elop), HUD repeater, GPS, AHRs, active matrix LCDs (Thales), air data computers and rear cockpit data entry panel.

ARMAMENT: One underfuselage and four underwing weapons pylons for bombs, rocket pods and gun pods.

DIMENSIONS, EXTERNAL:

Wing span	9.80 m (32 ft 1 $\frac{3}{4}$ in)
Wing aspect ratio	5.5
Length overall	10.91 m (35 ft 9 $\frac{1}{2}$ in)
Height overall	4.13 m (13 ft 6 $\frac{1}{2}$ in)
Wheel track	2.51 m (8 ft 2 $\frac{3}{4}$ in)
Wheelbase	4.525 m (14 ft 10 $\frac{1}{4}$ in)

AREAS:

Wings, gross	approx 17.5 m ² (188.4 sq ft)
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WEIGHTS AND LOADINGS (approx):

Max external stores load	1,000 kg (2,204 lb)
Max fuel weight (usable)	917 kg (2,022 lb)
T-O weight: clean	3,500 kg (7,716 lb)
max	4,500 kg (9,920 lb)

PERFORMANCE (estimated):

Max operating Mach No.	0.8
Max permissible diving speed	445 kt (824 km/h; 512 mph)
Max level speed at S/L	378 kt (700 km/h; 435 mph)
Service ceiling	12,000 m (39,370 ft)
Range (standard fuel)	540 n miles (1,000 km; 621 miles)
Endurance	3 h
g limits	+7.0/-2.5

ACCOMMODATION: Tandem seating, with elevated rear seat.

SYSTEMS: Optional OBOGS.

AVIONICS: To include CSIR/Bharat Electronics HUD and up-front control panel (UFCP) and HAL mission computer.

WEIGHTS AND LOADINGS:

External stores load	2,000 kg (4,409 lb)
Max T-O weight	7 tonne (15,430 lb) class

PERFORMANCE:

Max level speed	Transonic
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BANGALORE COMPLEX

Post Bag 1785, Bangalore 560 017

Tel: (+91 80) 522 82 30

Fax: (+91 80) 522 95 64

MANAGING DIRECTOR: A K Saxena

Bangalore Complex comprises Aircraft Division, Helicopter Division, Aerospace Division, Engine Division, Overhaul Division, Foundry and Forge Division, Industrial and Marine Gas Turbines Division, and Airport Services Centre. Programmes include subcontract work for leading aerospace companies such as BAE Systems, EADS, Airbus France, Boeing and Latécoère. Aircraft Division will complete 50 of 66 BAE Hawk Mk 132s ordered on 26 March 2004 for the Indian Air Force (eight from CKD kits, 42 by local manufacture, after delivery of 16 UK-built aircraft from BAE); first UK deliveries due in 2007.

Aerospace Division manufactures light alloy structures and assemblies for satellites and launch vehicles. Engine Division manufactures, overhauls and repairs Adour Mk 811, Artouste H1B and TPE331-5 engines; it also overhauls and repairs Adour Mk 804E, Dart, Gnome, Orpheus and Avon engines. Overhaul of Jaguar, Kiran, Mirage and An-32 aircraft, Cheetah helicopters and Pratt & Whitney and Textron Lycoming piston engines is undertaken by Overhaul Division.

AIRCRAFT DIVISION:

Post Bag 1788, Bangalore 560 017

Tel: (+91 80) 522 89 69

Fax: (+91 80) 522 51 88

GENERAL MANAGER: G Parasuramireddy

Main programmes Jaguar International production and upgrade; composites and metal drop tanks; Dornier 228 landing gears; sheet metal items; forward passenger doors for Airbus A320 family (600 shipsets initially; contract renewed and expanded to 1,000 sets in July 2004; about 500 sets delivered at that time); overwing emergency exits and other parts for Boeing 737, 757, 767 and 777. Floor area 125,100 m² (1,346,565 sq ft); workforce 2,102 in January 2003.

HELICOPTER DIVISION:

Post Bag 1790, Bangalore 560 017

Tel: (+91 80) 523 86 02

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GENERAL MANAGER: S M Kapoor

Manufacture and overhaul of Cheetah, Chetak, Lancer and Dhruv light helicopters, MoU in February 2004 for local production of rotor blades for Bell 206. Agreement with Eurocopter in 2005 to manufacture components for AS 350/550.

HAL (SEPECAT) JAGUAR INTERNATIONAL

Indian Air Force name: Shamsher (Assault Sword)

TYPE: Attack fighter.

Comprehensive details in Jane's Aircraft Upgrades; following refers to Indian versions.

PROGRAMME: Forty (including five two-seat) Jaguar Internationals with Adour Mk 804 engines delivered from UK, beginning March 1981; 45 more with Adour Mk 811s and new DARIN nav/attack system assembled in India, making first flight (JS136) 31 March 1982; IOC achieved 1984 and FOC 1985. Further 31 manufactured under licence in India (first delivery early 1988); deliveries of further 15, ordered 1993, were completed by March 1999 with delivery of last three of this batch. Indian government ordered additional batch of 17 two-seaters in March 1999. These being equipped with upgraded DARIN II nav/attack system and employed in a night attack role with laser-guided weapons; eight delivered to Indian Air Force by September 2004; further nine on 15 July 2005. Letter of intent for further 20 single-seaters has been received, which would extend Jaguar production until 2007; these also would have upgraded DARIN II nav/attack system and new LRMTS.

CURRENT VERSIONS: **Jaguar B(I)**: Two-seat trainer version; 15 delivered; further 15 on order with DARIN II nav/attack system, laser designator pod and modified fin; first eight of these due for delivery by end March 2004.

HAL HJT-39

TYPE: Advanced jet trainer/light attack.

PROGRAMME: Announced at Aero India, February 2005, as Combat Attack Trainer (CAT) 'initiative to develop' for Indian Air Force AJT (Advanced Jet Trainer) requirement, specifications for which being in final stages by IAF at the time; would compete for this with any additional orders for BAE Hawk. Mockup of front fuselage and cockpit shown. Projected to fly within three and a half years of go-ahead; airframe commonality with HJT-36 Sitara, avionics comparable with those of HJT-36 and Tejas. As of second quarter 2006, no go-ahead had been given.

CUSTOMERS: Potential Indian Air Force requirement for about 100; possibility of export sales.

Following details all provisional.

DESIGN FEATURES: Substantially a twin-engined derivative of HJT-36.

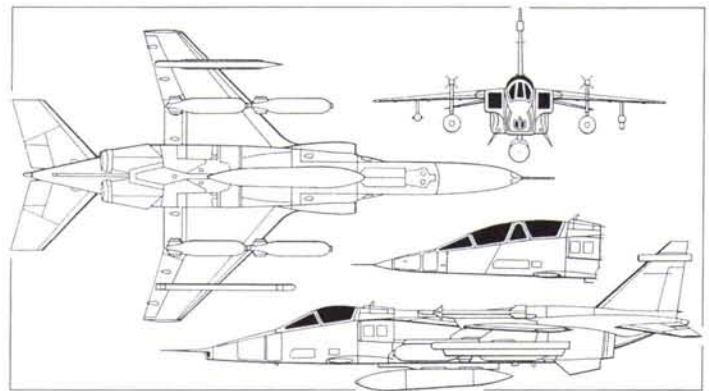
FLYING CONTROLS: Digital fly-by-wire.

POWER PLANT: Proposed with two 21.6 kN (4,850 lb st) Saturn/U'MPO AL-551 non-afterburning turbofans.



SEPECAT Jaguars in Indian service (IAF)

1042741



Jaguar single-seat tactical support aircraft and scrap view of two-seat operational trainer (Mike Keep)

1158036

Jaguar S(I): Standard single-seat strike version; 106 delivered; further 20 scheduled to follow.

Jaguar Maritime: Jaguars of IAF No. 6 Squadron, assigned to anti-shipping role, have Agave radar, interfaced with DARIN nav/attack system and Sea Eagle anti-shipping missiles; first modified aircraft delivered January 1986; 12 ordered, of which all delivered by end of 1999. To be upgraded by substitution of Elta EL/M-2032 for Agave, with which flight trials were under way in 2002. In 2001, deliveries began of a further two Jaguar M.

CUSTOMERS: Indian Air Force received 132, comprising 117 single-seat (including 12 Maritime) and 15 two-seat combat-capable trainers. Further 15 Jaguar Bs and two Ms (ordered 1999) in production for delivery from 2003; additional 20 single-seaters expected to follow. Basic strike version equips Nos. 5 ('Tuskers') and 14 ('Bulls') Squadrons at Ambala and Nos. 16 ('Cobras') and 27 ('Flaming Arrows') Squadrons at Gorakhpur; anti-shipping version equips 'A' Flight of No. 6 ('Dragons') Squadron at Pune.

DESIGN FEATURES: Purpose-designed attack aircraft. Shoulder-wing monoplane. Anhedral 3°. Sweepback 40° at quarter-chord. Outer leading-edges fitted with slat which also gives effect of extended chord. Tail unit sweepback at quarter-chord 40° on horizontal, 43° on vertical surfaces; tailplane anhedral 10°. Ventral fins beneath rear fuselage.

FLYING CONTROLS: Fairey Hydraulics powered flying controls. No ailerons; control by two-section spoilers, forward of outer flap on each wing, in association (at low speeds) with differential tailplane. Hydraulically operated (by screwjack) full-span double-slotted trailing-edge flaps. Leading-edge slats can be used in combat. All-moving slab-type tailplane, the two halves of which can operate differentially to supplement the spoilers.

STRUCTURE: Wing is an all-metal two-spar torsion box structure; skin machined from solid aluminium alloy, with integral stiffeners. Main portion built as single unit, with three-point attachment to each side of fuselage. Fuselage all-metal, mainly aluminium, built in three main units and making use of panels and, around the cockpit(s), honeycomb panels. Local use of titanium alloy in engine bay area. Two door-type airbrakes under rear fuselage, immediately aft of each mainwheel well. Structure and systems aft of cockpit(s), identical for single-seat and two-seat versions. The tail unit is a cantilever all-metal structure, covered with aluminium alloy sandwich panels. Rudder and outer panels and trailing-edge of tailplane have honeycomb core.

LANDING GEAR: Messier-Hispano-Bugatti retractable tricycle type, all units having Dunlop wheels and low-pressure tyres for rough field operation. Hydraulic retraction, with oleo-pneumatic shock-absorbers. Forward-retracting main units each have twin wheels, tyre size 615x225-10, pressure 5.8 bar (84 lb/sq in). Wheels pivot during retraction to stow

horizontally in bottom of fuselage. Single rearward-retracting nosewheel, with tyre size 550x250-6 and pressure 3.9 bar (57 lb/sq in). Twin landing/taxying lights in nosewheel door. Dunlop hydraulic brakes. Anti-skid units and arrestor hook standard. Irvin brake parachute of 5.5 m (18 ft 0 in) diameter in fuselage tailcone.

POWER PLANT: Two HAL-built Rolls-Royce Turbomeca Adour Mk 811 turboprops (Phase 3 aircraft onwards), each rated at 25.0 kN (5,620 lb st) dry and 37.4 kN (8,400 lb st) with afterburning. Fixed-geometry air intake on each side of fuselage aft of cockpit. Fuel in six tanks, one in each wing and four in fuselage. Total internal fuel capacity 4,200 litres (1,110 US gallons; 924 Imp gallons). Armour protection for critical fuel system components. Provision for carrying three auxiliary drop tanks, each of 1,200 litres (317 US gallons; 264 Imp gallons) capacity, on fuselage and inboard wing pylons. Provision for in-flight refuelling, with retractable probe forward of cockpit on starboard side.

ACCOMMODATION: Jaguar S(I) has enclosed cockpit for pilot, with rearward-hinged canopy and Martin-Baker Mk 9B zero/zero ejection seat. Jaguar B(I), crew of two in tandem on Martin-Baker Mk 9B Srs II zero/zero ejection seats. Individual rearward-hinged canopies. Rear seat 38 cm (15 in) higher than front seat. Windscreens bulletproof against 7.5 mm rifle fire.

SYSTEMS: Air conditioning and pressurisation systems for cockpit(s) also control temperature in certain equipment bays. Two independent hydraulic systems, powered by two engine-driven pumps. Hydraulic pressure 207 bar (3,000 lb/sq in). First system (port engine) supplies one channel of each actuator for flying controls, hydraulic motors which actuate flaps and slats, landing gear retraction and extension, brakes and anti-skid units. Second system supplies other half of each flying control actuator, two further hydraulic motors actuating slats and flaps, airbrake and landing gear emergency extension jacks, nosewheel steering and wheel brakes. In addition, there is a hydraulic power transfer unit and an emergency electrohydraulic pump.

Electrical power provided by two 15 kVA AC generators, either of which can sustain functional and operational equipment without load shedding. DC power provided by two 4 kW transformer-rectifiers. Emergency power for essential instruments provided by 40 Ah battery and static inverter. De-icing, rain clearance and demisting standard. Liquid oxygen system, which also pressurises pilot's anti-g trousers.

Jaguar is fully power-controlled in all three axes and is automatically stabilised as a weapons platform by gyros which sense disturbances and feed appropriate correcting data through a computer to the power control assemblies, in addition to human pilot manoeuvre demands. Power controls are all of duplex tandem arrangement, with mechanical and electrical servo-valves of Fairey platen design. Air-to-air combat capability can be enhanced by inclusion of roll/yaw dampers, to increase lateral stability, and by increasing slat and flap angles.

AVIONICS: HAL-manufactured DARIN (display attack and ranging inertial navigation) nav/attack system initially, incorporating INS, HUDWAC, COMED, interconnected MIL-STD-1553B dual-redundant databus and interfaced with LRMTS. The 17 new two-seaters and (when ordered) additional 20 strike versions will be fitted with DARIN II system incorporating new RLG/INS with GPS, new HUD and smart MFDs (see below); HOTAS upgrade postponed.

Comms: Main (20-channel) V/UHF; standby UHF and HAL COM 326A HF transceivers (being replaced by Incom integrated com system); IFF-400 AM transponder (single-seaters only).

Radar: Thales Avionics Agave originally in Maritime version, interfaced with DARIN system; planned to be replaced by Elta EL/M-2032.

Flight: SAGEM ULISS 82 INS (to be replaced by RLG/INGPS); HAL ADF and radar altimeter. Indian autopilot under development.

Instrumentation: Smiths HUDWAC (head-up display and weapon aiming computer) (to be replaced by Elbit HUD and dual HAL-developed mission computers); BAE Systems COMED 2045 (combined map and electronic display) to be replaced by Thales (Sextant) digital autopilot and 152 x 152 mm (6 x 6 in) smart multifunction display (SMFD), ordered November 1999.

Mission: Laser ranger and marked target seeker (LRMTS). Provisional selection of Rafael Litening laser designation pod announced February 1996.

Self-defence: Marconi RWR (replaced by Indian unit in DARIN II); active and passive ECM. Chaff dispenser added in DARIN II.

ARMAMENT: Two 30 mm Aden guns in lower fuselage aft of cockpit in single-seater, with 150 rds/gun; single Aden on port side in two-seater (to be removed to accommodate self-protection jammer). One stores attachment on fuselage centreline and two under each wing. Centreline and inboard wing points can each carry up to 1,134 kg (2,500 lb) of weapons, outboard underwing points up to 567 kg (1,250 lb) each. Typical alternative loads include one air-to-surface missile and two 1,200 litre (317 US gallon; 264 Imp gallon) drop tanks; eight 1,000 lb bombs; various combinations of free-fall, laser-guided, retarded or cluster bombs; overwing R.550 Magic missiles; air-to-surface rockets; or a reconnaissance camera pack. Maritime Jaguars equipped with one or two Sea Eagle anti-shipping missiles.

DIMENSIONS: EXTERNAL:

Wing span	8.72 m (28 ft 7 1/4 in)
Wing aspect ratio	3.1
Length overall, incl probe:	
single-seat	16.955 m (55 ft 7 1/2 in)
two-seat	17.52 m (57 ft 6 in)
Height overall	4.89 m (16 ft 0 1/2 in)
Wheel track	2.40 m (7 ft 10 1/2 in)
Wheelbase	5.69 m (18 ft 8 in)

INDIAN AIR FORCE JAGUARS				
Mark/Variant	Serial Nos.	Assembled ¹	Remarks	Qty
GR. Mk 1 S(I)	J1003 to 018	BAe	Loaned by/returned to RAF ²	(16)
	JS101 to 135	BAe	Phase 2: Adour 804, NAVWASS	35
	JS136 to 170	HAL	Phase 3: Adour 811, DARIN	35
	JS171 to 194	HAL	Phase 4: Adour 811, DARIN	24 ³
	JS195 to 205	HAL	Phase 5: Adour 811, DARIN	11
Maritime	JM251 to 258	HAL	Phase 4: Adour 811, DARIN, Agave	8 ³
	JM259 to 262	HAL	Phase 5: Adour 811, DARIN, Agave	4
	JM263 to 264	HAL	Phase 6	2
	JT001 to 002	BAe	Loaned by/returned to RAF ²	(2)
T. Mk 2 B(I)	JT051 to 055	BAe	Phase 2: Adour 804, NAVWASS	5
	JT056 to 065	HAL	Phase 3: Adour 811, DARIN	10
	JT066 to ?	HAL	Phase 6: night attack. Adour 811, DARIN II	17
Total				151 (18)

¹ All co-built by (SEPECAT) BAe and Dassault
² Adour 804 engines and NAVWASS nav/attack avionics; two single-seat lost in Indian service
³ Phase 4 originally planned as 56 aircraft of entirely local manufacture; amended to 32 kits

AREAS:	
Wings, gross	24.03 m ² (258.7 sq ft)
WEIGHTS AND LOADINGS:	
Typical weight empty	7,000 kg (15,432 lb)
Max external stores load (incl overwing)	4,763 kg (10,500 lb)
Normal T-O weight (single-seater, with full internal fuel and ammunition for built-in cannon)	10,954 kg (24,149 lb)
Max T-O weight with external stores	15,700 kg (34,612 lb)
Max wing loading	653.3 kg/m ² (133.79 lb/sq ft)
Max power loading	210 kg/kN (2.06 lb/lb st)
PERFORMANCE:	
Max level speed at S/L	M0.98 (648 kt; 1,200 km/h; 745 mph)
Max level speed above 6,000 m (19,680 ft)	M1.5 (907 kt; 1,680 km/h; 1,044 mph)
Touchdown speed	115 kt (213 km/h; 132 mph)
Service ceiling	13,715 m (45,000 ft)
T-O run, clean:	565 m (1,855 ft)
with four 1,000 lb bombs	880 m (2,890 ft)
with eight 1,000 lb bombs	1,250 m (4,100 ft)
T-O to 15 m (50 ft) with typical tactical load	940 m (3,085 ft)
Landing from 15 m (50 ft) with typical tactical load	785 m (2,575 ft)
Landing run:	
normal weight, with brake-chute	470 m (1,540 ft)
normal weight, without brake-chute	680 m (2,230 ft)
overload weight, with brake-chute	670 m (2,200 ft)
Typical attack radius, internal fuel only:	
hi-lo-hi	460 n miles (852 km; 530 miles)
lo-lo-lo	290 n miles (537 km; 334 miles)
Typical attack radius with external fuel:	
hi-lo-hi	760 n miles (1,408 km; 875 miles)
lo-lo-lo	495 n miles (917 km; 570 miles)
Range with max external fuel	1,400 n miles (2,593 km; 1,611 miles)
g limits	+8.6 (+12 ultimate)/-3

HAL DHRUV

English name: **Polaris**
 TYPE: Light utility helicopter.
 PROGRAMME:

DEVELOPMENT MILESTONES

Agreement with MBB	Jul 84
Design started	Nov 84
Rolled out	29 Jun 92
First flight	20 Aug 92
First flight (military)	28 May 94
First flight (naval)	23 Dec 95
First flight (civil)	6 Mar 02
First delivery (Coast Guard)	18 Mar 02
First civil order (Azal)	5 Feb 03
Certification (civil)	Oct 03

Agreement signed with MBB (Germany) July 1984 to support design, development and production of Advanced Light Helicopter (ALH); design started November 1984; ground test vehicle runs began April 1991; five flying prototypes (two basic, one air force/army, one naval and one civil); PT1 first prototype (Z3182) rolled out 29 June 1992; first flight 20 August and 'official' first flight 30 August 1992; PT2 second prototype (Z3183) made its first flight 18 April 1993; PT-A (army/air force prototype Z3268) on 28 May 1994; PT-N (naval prototype), with CTS 800 engines, flew for first time (IN901) on 23 December 1995. Total hours flown, including 'hot-and-high' trials in environments of 45°C (113°F) and more than 6,000 m (19,680 ft), were about 1,500. Military certification of air force/army, naval and coast guard versions completed in March 2002.

Naval trials by PT-N conducted in March 1998 aboard aircraft carrier *INS Virat* and smaller decks of other Indian Navy vessels. May 1998 US trade embargo, imposed following India's refusal to sign nuclear test ban treaty, blocked import of CTS 800 engines (30 ordered) and delayed planned first flight of PTC-2 civil fifth prototype (VT-XLH) with this engine until 6 March 2002. Instead, all current variants now powered by TM 333, including retrofit of PT-N prototype; contract announced 7 February 2003 for HAL to co-develop and co-produce Turbomeca Arididen 1H (Indian name Shakti) for future, higher-powered Army and Air Force versions of Dhruv. Weight reduction programme initiated in mid-1998; RFPs issued later same year for cockpit display system. By the end of 1998, manufacture was well advanced of three preproduction aircraft (PPN-1, PPA-2 and PPA-3; one for each of the three armed services).

Deliveries (four each to Indian Air Force and Army, two each to Navy and Coast Guard) were due to begin in late 1999 but programme slipped; new schedule provided for first two (to Army) instead becoming due for delivery by end of 2001, to be followed by two each to Coast Guard, Navy and Air Force by the end of March 2002. Seven deliveries actually achieved by this date: Army two (IA-1101 and -1103) starting 20 March 2002, Air Force two (J-4041/4042 on 20 March), Navy two (IN-701/702 on 28 March) and Coast Guard (CG-851 on 18 March) one. However, Army's IA-1102 had been delivered for trials use earlier, on 4 January 2002. Indian Navy user trials conducted on board *INS Godavari* in November 2002. Eight more scheduled for delivery by 31 March 2003, of which Indian Navy received two on 24 March; total deliveries had increased to 18 by June 2003 (Army eight, Air Force four, Navy and Coast Guard three each). Initial batch of 30 TM 333-2B2 ordered in mid-1999 to power first 12 (including two civil) production Dhruvs; all then



Indian Army HAL Dhruv

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Naval version of the Dhruv Advanced Light Helicopter, with additional side view (centre) of air force/army variant (*Mike Keep*)

0507145

intended for delivery by 2002. Further 52 TM 333s ordered mid-2000 to power next 20; deliveries of these almost completed by February 2003. Additional contract at that time for over 300 TM 333s (some of which to re-engine Cheetahs) and Ardidens, former type for delivery from early 2004.

Development and marketing agreement between HAL and Israel Aircraft Industries announced in late 2002; involves both Dhruv and LCH derivative; IAI (Lahav) to concentrate on integrated avionics package and other internal systems. Second prototype (PT2) equipped in 2003 as demonstrator, with suite including 'glass cockpit', MAWS and NVGs.

Indian Air Force Sarang (Peacock) display team formed 2003; made public debut at Aero India and Asian Aerospace air show, Singapore, February 2004. Four Dhruvs in extensive demonstration to Chilean armed forces in mid-2004.

CURRENT VERSIONS: **Air force/army:** Skid gear, crashworthy fuel tanks, bulletproof supply tanks, IR and flame suppression; night attack capability; roles to include attack and SAR. **Naval:** Retractable tricycle gear, SV-2000 surveillance radar, harpoon decklock, pressure refuelling; fairings on fuselage sides to house mainwheels, flotation gear and batteries.

Civil: Roles to include passenger and utility transport, commuter/offshore executive, rescue/emergency medical service and law enforcement. Wheel landing gear. Prototype targeted to fly in 2001, but this not achieved until 6 March 2002; DGCA certification received October 2003. Entered production in 2003. Launch customer Azal India Helicopter (one ordered 5 February 2003, for delivery later that year). Two civil Dhruvs ordered early 2005 by provincial government of Jharkand; first of three, ordered June 2005 by Indian Oil and Natural Gas Corporation, was handed over 11 August 2005.

Coast Guard: High commonality with naval version; nose-mounted surveillance radar; roof-mounted FLIR; starboard side, cabin-mounted 7.62 mm machine gun; radar console and operator's seat; liferaft, loudhailer.

LCH: Light attack development; *described separately*.

CUSTOMERS: Indian government requirement for armed forces and Coast Guard, to replace Chetaks/Cheetahs; letter of intent for 300 (Army 110, Air Force 150, Navy/Coast Guard 40) followed by contract for 100 in late 1996, but allocation revised by 2001 as Army 120, Navy 120, Air Force 60 and Coast Guard seven; all to be delivered by 2015. Initial Indian Army aircraft to 201 Squadron. Second production lot contains 20. HAL predicts total military/civil domestic orders for about 650.

According to Jane's sources, approx 45 delivered by January 2006 to Indian armed forces (Army 18 to 20, Air Force/Navy about 16); remainder to Coast Guard and various state governments. Two delivered to Royal Nepal Army 13 June 2004. HAL, registered (VT-HAR) 77th aircraft as a demonstrator in March 2006.

COSTS: Unit price of basic aircraft approximately INR250 million (USD5.2 million) (2002). Total programme costs USD170 million by 1997 (latest information provided).

DESIGN FEATURES: First modern helicopter of local design and construction. Conventional layout, including high-mounted tailboom to accommodate rear-loading doors. Four-blade hingeless main rotor with advanced aerofoils and sweptback tips; Eurocopter FEL (fibre elastomer) rotor head, with blades held between pair of cruciform CFRP starplates; manual blade folding and rotor brake standard; integrated drive system transmission; four-blade bearingless crossbeam tail rotor on starboard side of fin; fixed tailplane; sweptback endplate fins offset to port; vibration damping by Lord AVCS (active vibration control system), comprising four isolator elements between main gearbox and fuselage.

Main rotor blade section DMH 4 (DMH 3 outboard); tail rotor blade section S 102C (S 102E at tip). Rotor speeds 314 rpm (main), 1,564 rpm (tail).

FLYING CONTROLS: Integrated dynamic management by four-axis AFCS (actuators have manual as well as AFCS input); constant-speed rpm control, assisted by collective anticipator (part of FADEC and stability augmentation system acting through AFCS).



HAL Dhruv PT2 during demonstrations in Chile

1037983

STRUCTURE: Composites account for some 67 per cent of airframe. Main and tail rotor blades and rotor hub glass fibre/carbon fibre with Rohacell foam core and nickel or stainless steel leading-edge strips; Kevlar nosecone, crew/passenger doors, cowling, upper rear tailboom and most of tail unit; carbon fibre lower rear tailboom and fin centre panels; Kevlar/carbon fibre cockpit section; aluminium alloy sandwich centre cabin and remainder of tailboom.

LANDING GEAR: Non-retractable metal skid gear standard for air force/army version. Hydraulically retractable tricycle gear on naval and civil versions, with twin nosewheels and single mainwheels, latter retracting into fairings on fuselage sides which also (on naval version) house flotation gear and batteries; rearward-retracting nose unit; naval version has harpoon decklock system. Spring skid under rear of tailboom on all versions, to protect tail rotor. FPT Industries (UK) Kevlar inflatable flotation bags for prototypes, usable with both skid and wheel gear.

POWER PLANT: First three, and fifth, prototypes each powered by two Turbomeca TM 333-2B2 or -2C turboshafts, with FADEC, rated at 740 kW (993 shp) for T-O, 783 kW (1,050 shp) maximum contingency and 666 kW (893 shp) maximum continuous. LHTEC CTS 800-4H (998 kW; 1,338 shp) selected late 1994 and test-flown in fourth prototype, but subsequently embargoed; all now to have TM 333-2B2 until availability of 895 kW (1,200 shp) class Aridien 1H (Shakti). Latter engine will be confined to army and air force Dhruvs, to enhance operation in 'hot and high' conditions. Engine flight testing due to start in mid-2006.

Transmission ratings (two engines) 1,280 kW (1,716 shp) for 30 minutes for T-O and 1,156 kW (1,550 shp) maximum continuous; OEI ratings 800 kW (1,073 shp) for 30 seconds (super contingency), 700 kW (939 shp) for 2½ minutes. Transmission input from both engines combined through spiral bevel gears to collector gear on stub-shaft. AVCS system (see Design Features) gives 6° of freedom damping. Power take-off from main and auxiliary gearboxes for transmission-driven accessories.

Total usable fuel, in self-sealing crashworthy underfloor tanks (three main and two supply), 1,400 litres (370 US gallons; 308 Imp gallons). Pressure refuelling in naval version. Crossfeed and fuel dump systems in all military versions. Provision for carrying additional fuel tanks in cabin.

ACCOMMODATION: Flight crew of two, on crashworthy seats in military/naval versions. Main cabin seats 12 persons as standard, 14 in high-density configuration. EMS interior (first flown by PT/Z3183 in January 2001) can accommodate two stretchers and four medical attendants, or four stretchers and two medical personnel. Crew door and rearward-sliding door (military) or hinged door (civil) on each side; clamshell cargo doors at rear of passenger cabin.

SYSTEMS: DC electrical power from two independent subsystems, each with a 6 kW starter/generator, with battery back-up for 15 minutes of emergency operation; AC power, also from two independent subsystems, each with a 5/10 kVA alternator. Three hydraulic systems (pressure 207 bar; 3,000 lb/sq in, maximum flow rate 25 litres; 6.6 US gallons; 5.5 Imp gallons)/min: systems 1 and 2 for main and tail rotor flight control actuators, system 3 for landing gear, wheel brakes, decklock harpoon, rescue hoist (naval variant) and optional equipment. Oxygen system.

AVIONICS (early aircraft): *Comms:* V/UHF, HF/SSB and standby UHF com radio, IFF and intercom.

Radar: Weather radar optional. LRDE SuperVision-2000 360° 1-band surveillance radar in Navy/Coast Guard version.

Flight: SFIM four-axis AFCS, Doppler navigation system, TAS system, ADF, radio altimeter, heading reference standard, GPS nav system in civil version, with additional VOR/ILS, DME and marker beacon.

Mission: Roof-mounted FLIR in Coast Guard version, EMS version equipped with nav aids, patient monitoring, data recording systems, and datalink to transmit medical information to ground-based hospitals.

AVIONICS (IAI upgrade package): Integrated, modular 'glass cockpit' suite includes comprehensive self-defence equipment (radar and laser warning receivers, MAWS and 30-cartridge chaff/flare dispenser each side); day and night observation capability (TV, FLIR and laser rangefinder); targeting system; flexible weapon-carrying capability; four 152 × 203 mm (6 × 8 in) LCDs; INS/GPS navigation (Doppler GPS optional); and standby horizon, ASI and altimeter.

EQUIPMENT: Depending on mission, can include two to four stretchers, external rescue hoist, liferaft and 1,500 kg (3,307 lb) capacity cargo sling.

ARMAMENT: Cabin-side pylons for two torpedoes/depth charges or four anti-ship missiles on naval variant; on army/air force variant, stub-wings which can be fitted with eight anti-tank guided missiles, four pods of 68 mm or 70 mm rockets or two pairs of air-to-air missiles. Army/air force variant can also be equipped with ventral 20 mm gun turret or sling for carriage of land mines. Cabin-mounted 7.62 mm machine gun in Coast Guard version, firing from starboard side doorway.

DIMENSIONS, EXTERNAL:

Main rotor diameter	13.20 m (43 ft 3¼ in)
Main rotor blade chord: inboard	0.50 m (1 ft 7¾ in)
at tip	0.165 m (6½ in)
Tail rotor diameter	2.55 m (8 ft 4½ in)
Length:	
overall, both rotors turning	15.87 m (52 ft 0¾ in)
fuselage (except Coast Guard version)	13.43 m (44 ft 0¾ in)
Height: overall, tail rotor turning:	
army/air force version	4.98 m (16 ft 4 in)
naval version	4.91 m (16 ft 1¼ in)
to top of main rotor head:	
army/air force version	3.93 m (12 ft 10¾ in)
naval version	3.76 m (12 ft 4 in)
Fuselage max width	2.00 m (6 ft 6¾ in)
Width over mainwheel sponsons (naval version)	3.15 m (10 ft 4 in)
Tail unit span (over fins)	3.19 m (10 ft 5½ in)
Wheel track (naval version)	2.80 m (9 ft 2¼ in)
Wheelbase (naval version)	4.37 m (14 ft 4 in)
Skid track (army/air force version)	2.60 m (8 ft 6¾ in)
Tail rotor ground clearance	2.34 m (7 ft 8¼ in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck: Max width	1.97 m (6 ft 5½ in)
Max height	1.42 m (4 ft 8 in)
Volume	7.33 m³ (259 cu ft)
Cargo compartment volume	2.16 m³ (76.3 cu ft)

AREAS:

Main rotor disc	136.85 m² (1,473.0 sq ft)
Tail rotor disc	5.11 m² (55.0 sq ft)
Main fin	2.126 m² (22.88 sq ft)
Endplate fins (total)	1.45 m² (15.61 sq ft)
Tailplane	2.40 m² (25.83 sq ft)

WEIGHTS AND LOADINGS (A: army/air force standard, B: naval version):

Weight empty, equipped: A	2,550 kg (5,622 lb)
B	2,685 kg (5,919 lb)
Max fuel weight: A	1,075 kg (2,370 lb)
B	1,140 kg (2,513 lb)
Max sling load: A	1,000 kg (2,205 lb)
B	1,500 kg (3,307 lb)
Max T-O weight: A	4,500 kg (9,920 lb)
B	5,500 kg (12,125 lb)
Max disc loading: A	32.9 kg/m² (6.74 lb/sq ft)
B	40.2 kg/m² (8.23 lb/sq ft)

Transmission loading at max T-O weight and power:

A	3.04 kg/kW (4.99 lb/shp)
B	3.72 kg/kW (6.10 lb/shp)

PERFORMANCE (A and B as above, at MTOW at S/L, ISA + 15°C):

Never-exceed speed (VNE):	
A	178 kt (330 km/h; 205 mph)
B	162 kt (300 km/h; 186 mph)
Max cruising speed: A	143 kt (265 km/h; 165 mph)
B	135 kt (250 km/h; 155 mph)
Econ cruising speed: A	121 kt (225 km/h; 140 mph)
B	119 kt (220 km/h; 137 mph)
Max rate of climb at S/L: A	780 m (2,559 ft)/min
B	600 m (1,968 ft)/min
Service ceiling: A	6,500 m (21,320 ft)
B	4,580 m (15,020 ft)
Hovering ceiling:	
IGE: A	4,400 m (14,435 ft)
B	1,900 m (6,235 ft)
OGE: A	3,800 m (12,470 ft)
B	1,200 m (3,940 ft)
Radius with 2 crew and 10 passengers	120 n miles (222 km; 138 miles)
Range with max fuel, 20 min reserves:	
A	378 n miles (700 km; 435 miles)
B	351 n miles (650 km; 403 miles)
Endurance, conditions as above:	
A	4 h 20 min
B	4 h 0 min

HAL CHEETAH and CHEETAL

TYPE: Light utility helicopter.

PROGRAMME: *Cheetah* is licence-built Aerospatiale SA 315B Lama. Production by HAL for Indian armed forces started 1972. In early 2000, HAL received further orders for production for several years and has taken up employment of 746 kW (1,000 shp) Turbomeca TM 333-2B2 turboshaft to enhance performance. With this engine, aircraft is renamed *Cheetal*. On 2 November 2004, an Indian Air Force Cheetal set a new world record of 7,666 m (25,150 ft) for the highest density altitude landing by a helicopter (equivalent pressure altitude 7,077 m; 23,220 ft).

CUSTOMERS: HAL had delivered 260 (including 20 supplied by France) by mid-2002, at which time manufacture of a batch of 10 for the Indian Air Force was under way, and order for further five anticipated. Re-engining with TM 333-2B2 engines in programme to enhance performance; prototype (Z3455) flew for first time on 1 February 2003; prospect of entire (Indian) fleet retrofit of up to 230 aircraft. Upgrade also includes integrated helmet, countermeasures dispensing system and oxygen system.



Prototype HAL Cheetal (Turbomeca TM 333 turboshaft) (Paul Jackson)

1127714

HAL LANCER

TYPE: Armed observation helicopter.

PROGRAMME: Upgraded, counter-insurgency version of Cheetah. Prototype, rebuilt from late production aircraft Z2867, unveiled late 1998; cabin has lightweight composites armour protection for pilot, control linkages and fuel tank; bulletproof flat-plate transparencies; twin gun/rocket pods. Can be rebuild or new production.

CUSTOMERS: Indian Army order for 12 (converted from Cheetah), of which five delivered March 2002; remainder due to follow during 2003. Ten ordered in November 2001 by Nepal for newly established Armed Police Force. No further orders known by mid-2006.

ACCOMMODATION: Crew of two, side by side; cleared for single-pilot operation.



HAL Lancer prototype, an armed and armoured version of the Cheetah

0099550

ARMAMENT: Tubular metal outrigger each side of cabin, outboard of landing skids, each supporting jettisonable pod containing one 12.7 mm machine gun and three 70 mm unguided air-to-surface rockets. Pilot's gunsight.

WEIGHTS AND LOADINGS:

Basic weight empty: Cheetah	1,090 kg (2,403 lb)
Lancer, incl weapon pods	1,350 kg (2,976 lb)
Fuel weight	393 kg (866 lb)
Ammunition (500 rds) and six rockets	130 kg (287 lb)
Max T-O weight	1,950 kg (4,299 lb)

PERFORMANCE:

Never-exceed speed (VNE)	113 kt (210 km/h; 130 mph)
Cruising speed at S/L, ISA + 20 °C	95 kt (176 km/h; 109 mph)
Max rate of climb at S/L	330 m (1,083 ft)/min
Service ceiling	5,400 m (17,720 ft)
Operational radius, incl 30 min over target and 20 min fuel reserves, ISA + 20 °C	78 n miles (145 km; 90 miles)
Endurance	2 h 30 min

HAL CHETAK and CHETAN

TYPE: Light utility helicopter.

PROGRAMME: **Chetak** is licence-built Aerospatiale SA 316B Alouette III; remains in production only in India. HAL output had totalled at least 359 (of which 35 built from French kits) by mid-2002. Further orders, to prolong production for several years, received in early 2001. With original Artouste IIIB piston engine replaced by Turbomeca TM 333-2M2 (started January 2005), aircraft is renamed **Chetan**; increases service ceiling to 6,492 m (21,300 ft). First flight in this form took place 1 February 2005.



The TM 333-powered Chetan, which made its maiden flight on 1 February 2005 (Jane's/Patrick Allen) 1136588

TRANSPORT AIRCRAFT DIVISION

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GENERAL MANAGER: D K Mahajan

This Division established in 1960 to manufacture Hawker Siddeley (Avro) 748; is currently responsible for manufacture of the Dornier 228, and for overhaul, maintenance and repair of the Dornier 228, HS 748, HAL HPT-32 and civil aircraft. Co-operation agreement with Israel Aircraft Industries 21 February 2002 involves HAL in IAI (Bedek) Boeing 737 freighter conversion programme. Division assisted in design and development, and manufacturing prototypes, of the CSIR Saras (which see); series production at Kanpur is planned. Also plans co-production of ATR 42/72, for which launch order still awaited in early 2005. Co-design and development of Il-214 with Ilyushin and IAP to fulfill IRTA-21 (Indo-Russian Transport Aircraft, 21st century) requirement.

Division holds ISO 9001 and ISO 14001 accreditation and is equipped with Transport Aircraft Research and Design Centre (TARDC) specialising in role modifications, sensor integration, aircraft upgrades and repair technology.

HAL (DORNIER) 228

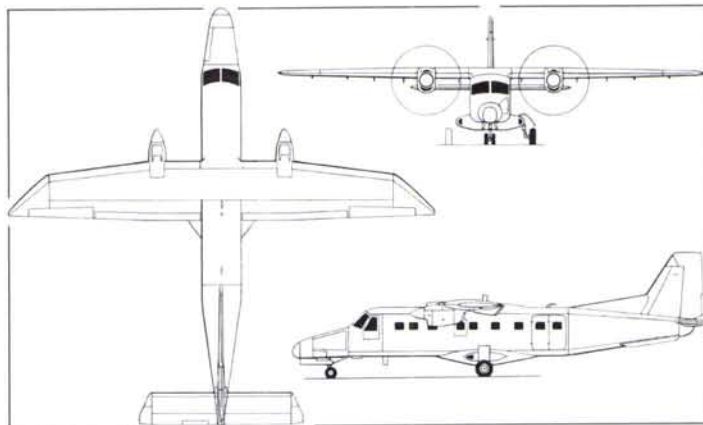
TYPE: Twin-turboprop transport.

PROGRAMME: First flight of Dornier 228-100 prototype (D-IFNS) in Germany 28 March 1981; first flight 228-200 prototype (D-ICDO) 9 May 1981; British CAA certification 17 April 1984, FAR Pt 23 and Appendix A Pt 135 11 May 1984, Australian 11 October 1985. European production (including 11 for India), is not described here.

Contract for licensed manufacture of up to 150 Dornier 228s in India signed 29 November 1983; one pattern aircraft supplied complete from Germany; production planned in four phases (six, 10, 10 and 43 aircraft respectively). fourth phase representing full local manufacture after production from locally assembled kits; first Phase 1 Kanpur-assembled aircraft (VT-EJN, c/n 1002) handed over to Vayudoot on 1 November 1985 and made maiden flight on 31 January 1986. Full local manufacture from 18th onwards (CG758, first flight 7 March 1991). Indian production programme dormant from



Indian Navy Dornier 228-201 0566569



HAL (Dornier) 228-201 (two TPE331 turboprops) (Dennis Punnett)

0507143

first quarter of 1997, but was continuing with production (early 2003) of three for Indian Air Force. Additional 11 aircraft for Indian Navy and Coast Guard were sanctioned by Indian Cabinet Committee on Security on 29 March 2005.

Following discontinuation of German production, worldwide sales and marketing rights held by HAL, since November 1998; HAL pursuing export market and anticipates future orders to maintain production for further eight to 10 years. Power plant, landing gear and some avionics also manufactured by HAL to preserve self-sufficiency.

CURRENT VERSIONS: **Regional Airliner:** Ten 228-201s (five each by Dornier and HAL) delivered to Vayudoot.

Maritime Surveillance: Thirty-six ordered for Indian Coast Guard (including three from Germany, delivered from July 1986); CG754 first flight 18 February 1988; first 18 from Indian production are 228-101s and were delivered by March 1997. Go-ahead for next batch (seven 228-201s) received in September 1999; these ordered under USD72 million contract in early 2000, of which all delivered in basic configuration by early 2003, with sensor integration then under way. One to Mauritius Coast Guard in 1990; second delivered in 2004.

In service with Coast Guard Air Squadrons at Daman and Chennai for coastal, environmental and anti-smuggling patrol: 360° Marec 2 search radar under fuselage (replaced in 15 aircraft by Super Marec and last seven to have 360° Elta EL/M-2022A(V)3 radar); Matra infra-red/ultraviolet linescanner for pollution detection. Latest production batch also have IAI Tamam AMOSP and datalinks (see Anti-ship paragraph below). Search and rescue life rafts, searchlight, hand-held aerial camera, bubble windows, side-mounted loudhailer, marine markers, and provision for two Micronair underwing spraypods to combat oil spills; in-flight-openable roller door for parajumping/paratrooping. Normal crew two pilots, radar operator and observer. Optional armament includes two underwing 7.62 mm twin-gun pods.

Anti-ship: Indian Navy acquired 25 specially equipped Dornier 228-201s (ordered in batches of five, 10 and 10). Deliveries began (IN221) on 24 August 1991 for service with INAS 310 ('Cobras') at Dabolim; last batch of 10 completed in 2000. First two batches have Super Marec 360° radar; Elta EL/M-2022A search radar in second batch of 10 (integration of eight completed by early 2003). Apart from radar (360° scan, near-SAR/MTI and track-while-scan) under forward fuselage, current aircraft have IAI Tamam Airborne Multimission Optronic Stabilised Payload (AMOSP) (TV/FLIR/laser range-finder) ball turret in starboard main gear fairing; air/ground data downlink; and cabin consoles for four systems operators with MFDs and moving map display.

Utility transport: Indian Air Force received 25 228-201s; deliveries started (HM667 and HM668) 15 December 1987 to Nos. 41 'Otters' and 59 'Hornbills' Squadrons; can carry 21 field-equipped troops on inward-facing composites folding seats; large HAL-developed cargo double door, to meet IAF requirement, at rear, port side. Expectation of IAF follow-on order for further 18, but only three extra aircraft included in batch due for delivery by March 2003; no further orders by April 2006.

Executive/Air taxi: Various configurations including six- or 10-seat executive or 15-passenger air taxi, with customised interior, cabin attendant, work table and galley/wardrobe/lavatory; built-in APU for air conditioning and lighting in flight or on ground. One (VT-EIX) for Indian Oil and Natural Gas Corporation.

CUSTOMERS: HAL deliveries are given in the accompanying table. The company anticipates building a further 56 aircraft beyond the 72 currently produced.

COSTS: USD166 million approved for acquisition of 11 aircraft (2005).

DESIGN FEATURES: Optimised for efficient cruising flight. High wing for propeller clearance, despite minimised fuselage ground clearance and pannier-mounted landing gear. Variable sweep wing leading-edge; unswept tailplane; sweptback fin with dorsal fillet.

Special Dornier wing with Do A-5 supercritical aerofoil; 8° leading-edge sweep on outer wing panels; raked tips; no dihedral or anhedral.

FLYING CONTROLS: Conventional and manual. Variable incidence tailplane with actuator switch on aileron wheel; horn-balanced elevators; rudder trim tab; single-slotted Fowler flaps augmented by drooping ailerons; two strakes under rear fuselage for low-speed stability.

STRUCTURE: Two-spar wing box; mainly light alloy structure, but with CFRP wingtips and tips of tailplane and elevators; GFRP nosecone, tips of rudder and fin; Kevlar landing gear fairings and in part of wing ribs; hybrid composites in fin leading-edge; fuselage unpressurised, built in five sections.

LANDING GEAR: Retractable tricycle type, with single mainwheels and twin-wheel nose unit; main units retract inward into fuselage fairings; hydraulically steerable nosewheels retract forward; Goodyear wheels and tyres, 25.5x8.75-10 (650x220-10) (10/12 ply) or 8.50-10 (10 ply) on mainwheels, 6.00-6 (8 ply), on nosewheels.

POWER PLANT: HAL-built Dornier 228-201s have two HAL-built Honeywell TPE331-5-252D turboprops, each flat rated at 533 kW (715 hp) to ISA +18°C and driving a Hartzell four-blade fully feathering propeller with reverse pitch. Post-2000 production aircraft have HAL-built TPE331-10 series engines; performance improvements of -5 engines through turbine blade enhancements also planned.

Primary wing box forms integral fuel tank with standard usable capacity 2,386 litres (630 US gallons; 525 Imp gallons); can be increased to 2,850 litres (753 US gallons; 627 Imp gallons). Oil capacity per engine 5.9 litres (1.56 US gallons; 1.30 Imp gallons).

ACCOMMODATION: Crew of one or two; pilots' seats adjustable fore and aft; two-abreast seating with central aisle; maximum capacity 19 (more in military versions); commander, AMOSP operator and two radar specialists in Coast Guard version. Flight deck door on port side; combined two-section passenger and freight door, with integral steps, on port side of cabin at rear; one emergency exit on port side of cabin, two on starboard side; baggage

GERMAN/INDIAN DORNIER 228 DELIVERIES
(to January 2005)

Country	Operator	Series	Dornier	HAL/CKD	HAL	Total
India	Air Force	201		5	23	28
		201	1	1		2
		101	3	4	11	18
		201			7	7
	Navy	201	1		14	15
		101	1			1
		101		1		1
	Vayudoot	201	5	5		10
		101			2	2
	Coast Guard					
Totals			11	16	57	84

compartment at rear of cabin, accessible externally and from cabin; capacity 210 kg (463 lb). Enlarged baggage door optional; additional baggage space in fuselage nose, with separate access; capacity 120 kg (265 lb); modular units using seat rails for rapid changes of role.

SYSTEMS: Entire accommodation heated (by engine bleed air) and ventilated. Hydraulic system, pressure 207 bar (3,000 lb/sq in), for landing gear, brakes and nosewheel steering; hand pump for emergency landing gear extension. Primary 28 V DC electrical system, supplied by two 28 V 250 A engine-driven starter/generators and two 24 V 25 Ah Ni/Cd batteries; two 350 VA inverters supply 115/26 V 400 Hz AC system. Air intake anti-icing standard; de-icing system optional for wing and tail unit leading-edges, fuselage, windscreen and propellers.

AVIONICS: *Comms:* Standard avionics include Rockwell Collins dual VHF-22A and single HF-230 com; Becker audio selector and intercom; Motorola Selcal; H R Smith ELT-503.

Radar: HAL-built Primus 500 weather radar; Elta EL/M-2022A(V)3 or Super Marec 360° search radars.

Flight: Dual Rockwell Collins VIR-32A VOR/ILS; dual or single Rockwell Collins ADF-62A; dual or single Bendix/King KNI 582 RMI indicators; dual or single Rockwell Collins DME-42. Bendix/King KFC 250 autopilot optional to permit single-pilot IFR operation.

Instrumentation: IFR instrumentation standard, comprising dual Honeywell GH14B gyro horizons; dual ADIs; dual VSIs.

EQUIPMENT: Standard equipment includes complete internal and external lighting, hand fire extinguisher, first aid kit, gust control locks and tiedown kit. Stores attachment points beneath each wing outboard of engine nacelle. Indian Navy aircraft reported to have provision for up to four anti-ship missiles.

ARMAMENT: Provision for gun pod, other weapons or mission pod under each wing.

DIMENSIONS, EXTERNAL:

Wing span	16.97 m (55 ft 8 in)
Wing aspect ratio	9.0
Length overall	16.56 m (54 ft 4 in)
Height overall	4.86 m (15 ft 11½ in)
Tailplane span	6.45 m (21 ft 2 in)
Wheel track	3.30 m (10 ft 10 in)
Wheelbase	6.29 m (20 ft 7½ in)
Propeller diameter	2.69 m (8 ft 10 in)
Propeller ground clearance	1.08 m (3 ft 6½ in)
Passenger door (port, rear): Height	1.35 m (4 ft 5 in)
Width	0.64 m (2 ft 1¼ in)
Height to sill	0.91 m (2 ft 11¾ in)
Freight door (port, rear): Height	1.35 m (4 ft 5 in)
Width, incl passenger door	1.28 m (4 ft 2½ in)
Emergency exits (each): Height	0.66 m (2 ft 2 in)
Width	0.48 m (1 ft 7 in)
Baggage door (nose): Height	0.50 m (1 ft 7½ in)
Width	1.20 m (3 ft 11¼ in)
Standard baggage door (rear):	
Height	0.90 m (2 ft 11½ in)
Width	0.53 m (1 ft 9 in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck and rear baggage compartment:	
Length	7.08 m (23 ft 2¾ in)
Max width	1.346 m (4 ft 5 in)
Max height	1.55 m (5 ft 1 in)
Floor area	9.6 m² (103 sq ft)
Volume	14.7 m³ (519.1 cu ft)
Rear baggage compartment volume	2.6 m³ (92 cu ft)
Nose baggage compartment volume	0.89 m³ (31.4 cu ft)

AREAS:

Wings, gross	32.00 m² (344.3 sq ft)
Ailerons (total)	2.71 m² (29.17 sq ft)
Trailing-edge flaps (total)	5.87 m² (63.18 sq ft)
Fin, incl dorsal fin	4.50 m² (48.44 sq ft)
Rudder, incl tab	1.50 m² (16.15 sq ft)
Horizontal tail surfaces (total)	8.33 m² (89.66 sq ft)

WEIGHTS AND LOADINGS (Indian-built 228-201):

Operating weight empty	3,687 kg (8,128 lb)
------------------------	---------------------

Max T-O weight: civil	6,200 kg (13,668 lb)
military	6,400 kg (14,110 lb)
Max ramp weight: civil	6,230 kg (13,734 lb)
military	6,430 kg (14,175 lb)
Max landing weight	6,100 kg (13,448 lb)
Max zero-fuel weight	5,590 kg (12,324 lb)
Max wing loading: civil	193.8 kg/m² (39.68 lb/sq ft)
military	200.0 kg/m² (40.96 lb/sq ft)
Max power loading: civil	5.82 kg/kW (9.56 lb/shp)
military	6.00 kg/kW (9.87 lb/shp)

PERFORMANCE (228-201):

Never-exceed speed (VNE)	255 kt (472 km/h; 293 mph) IAS
Max operating speed (VMO)	223 kt (413 km/h; 256 mph) IAS
Max cruising speed: at S/L	222 kt (411 km/h; 255 mph)
FL 100	231 kt (428 km/h; 266 mph)
Stalling speed: flaps up	79 kt (147 km/h; 91 mph) IAS
flaps down	63 kt (117 km/h; 73 mph) IAS
Max rate of climb at S/L	582 m (1,909 ft)/min
Service ceiling, 30.5 m (100 ft)/min rate of climb	8,535 m (28,000 ft)
Service ceiling, OEI, 15 m (50 ft)/min rate of climb	3,870 m (12,700 ft)
T-O run	442 m (1,450 ft)
T-O to 15 m (50 ft)	580 m (1,905 ft)
Accelerate/stop distance, with anti-skid	762 m (2,500 ft)
Landing from 15 m (50 ft) at MLW	457 m (1,500 ft)
Range at FL 100 with 19 passengers, reserves for 50 n mile (93 km; 57 mile) diversion, 45 min hold and 5% fuel remaining:	
at max cruising speed	560 n miles (1,038 km; 645 miles)
at max range speed	630 n miles (1,167 km; 725 miles)
Range with 775 kg (1,708 lb) payload, conditions as above:	
at max cruising speed	1,160 n miles (2,148 km; 1,335 miles)
at max range speed	1,320 n miles (2,445 km; 1,519 miles)

MiG COMPLEX

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M Fakrudin (Su-30, Nasik)

J R Mehta (Koraput Engine Division)

D N Vyas (Su-30 Engine Division, Koraput)

This complex comprises the Nasik Aircraft and Koraput Engine Divisions of HAL. Activities include MiG-21/27 upgrade, overhaul and repair, which continue at original Nasik facility.

Licensed manufacture of Sukhoi Su-30MKI is also responsibility of this complex, taking place at new facility located at Koraput. Agreement signed at Nasik 28 December 2000 for licensed local manufacture of up to 140 following earlier order for initial batch of 50 Russian-built Su-30Ks (deliveries from 1997 and completed in December 2004); contract valued at USD3.7 billion; HAL investment in programme reportedly valued at USD650 million.

HAL manufacture started in 2004 (first two sets of components received on 7 June) and being undertaken in four stages. Stage 1, involving 26 aircraft in three batches, concerns HAL assembly from Russian-built CKD kits. The first in this batch (SB 102) was rolled out on 28 November 2004, and the first pair handed over to the Indian Air Force on 21 March 2005. The remaining 114 were to have been completed in Phase 2 (equipping of major assemblies). Phase 3 (local manufacture of entire airframe except fuselage) and Phase 4 (all airframe and engine components manufactured locally), with completion in 2017 or 2018. However, programme accelerated in 2006 at Indian request, moving Phase 3 and 4 deliveries into Phase 2 and 3 time frame to enable completion in about 2012. As of May 2006, a delivery contract for 18 HAL-built aircraft had been signed. Agreement also provides for HAL-built canards, fins and tailplanes to be supplied for Russian production line. HAL divisions at Hyderabad (radio and radar), Korwa (avionics and EO equipment) and Lucknow (hydraulics/pneumatics) also involved in Su-30MKI programme. Various systems upgrades are expected to be introduced during the manufacturing period.

IITB

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The Programme on Airship Design and Development (PADD) was launched at IITB in 2001, with team members drawn from various national aerospace organisations and private sector companies in India. PADD aims at developing airship technology in India for various

scientific and commercial applications. The first phase of PADD, a study project sponsored by a department of the Ministry of Science and Technology, was completed in 2003. In this, conceptual design studies were carried out of airships for transportation of goods and passengers over mountainous terrain under 'hot and high' conditions.

Development of two types of airship is proposed in future phases: the PADD Demo and the PADD PaxCargo. Funding for these future phases was awaited in 2006. At that time, the PADD team was developing an unmanned airship with payload capacity of approximately 35 kg (77 lb) for several scientific applications such as aerial photography and surveillance. Studies were also under way in the areas of design and development of stratospheric airships; shape optimisation of aerostat and airship envelopes; development of robust control systems for unmanned airships; and feasibility of airships for transportation of heavy cargo. An indoor remotely controlled airship with a lenticular envelope has also been developed.

IITB PADD AIRSHIPS

TYPE: Helium non-rigid airships.

PROGRAMME: PADD programme launched 2001 and Phase 1 completed 2003; funding awaited in 2005 for Phase 2 and beyond. No subsequent information.

CURRENT VERSIONS: **PADD Micro:** Phase 1 remotely controlled, unmanned prototype for PADD Demo; developed and test-flown January 2002.

PADD Mini: Phase 1 remotely controlled, unmanned prototype for PADD PaxCargo; developed and demonstrated during 90th Indian Science Congress, January 2003.



IITB/PADD Micro airship

1178278



IITB/PADD Mini airship

1159032

IITB Indoor: Remotely controlled, with lenticular envelope shape, developed and demonstrated during IUCAA Science Fair, 2004.

PADD Demo: Phase 2 manned airship with 100 kg (220 lb) payload capacity.

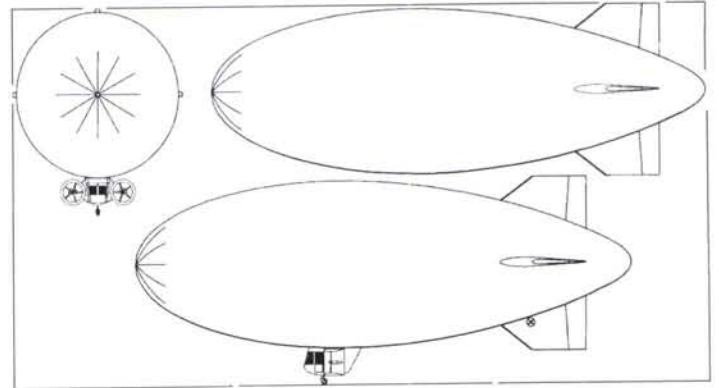
PADD PaxCargo: Phase 2 follow-on manned design, with payload capacity for 15 passengers or 1,500 kg (3,307 lb) of cargo.

DIMENSIONS, EXTERNAL:

Length overall: Micro	5.00 m (16 ft 4 3/4 in)
Mini	6.70 m (21 ft 11 3/4 in)
Demo	26.78 m (87 ft 10 1/4 in)
PaxCargo	70.00 m (229 ft 8 in)
Max diameter: Demo	8.78 m (28 ft 9 3/4 in)
PaxCargo	17.50 m (57 ft 5 in)
Height overall: Demo	11.00 m (36 ft 1 in)
PaxCargo	21.15 m (69 ft 4 3/4 in)
Span over tailfins: Demo	9.10 m (29 ft 10 1/4 in)
PaxCargo	19.40 m (63 ft 7 3/4 in)

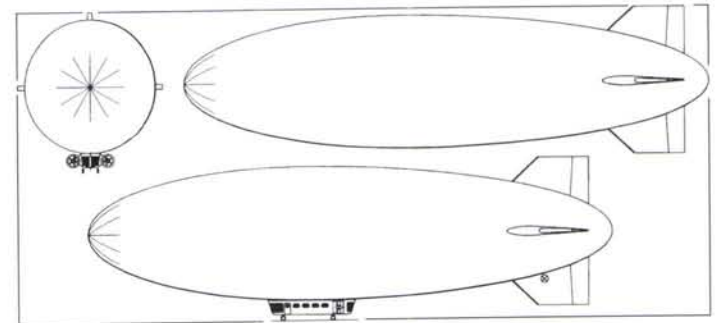
DIMENSIONS, INTERNAL:

Envelope volume: Micro	6.80 m ³ (240 cu ft)
Mini	8.60 m ³ (304 cu ft)



General arrangement of the proposed PADD Demo airship (Paul Jackson)

1158276



General arrangement of the proposed PADD PaxCargo airship (Paul Jackson)

1042483

NAL

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The NAL's current major civil aircraft programmes are the CSIR Saras twin-turboprop transport (which see), now undergoing certification flight test, and the Hansa-3 two-seat trainer and sportplane, in low-rate series production.

NAL HANSA-3

English name: Swan

TYPE: Primary prop trainer/sportplane.

PROGRAMME: Developed under agreement with Indian National Aerospace Laboratories and originally known as NALLA: NAL Light Aircraft. Design started May 1989; construction of Hansa-2 prototype began December 1991, and this aircraft (VT-XIW) made first flight 23 November 1993. Prototype received Indian DGCA Experimental category type certificate; re-engined 1995 as Hansa-2RE with more powerful IO-240 replacing original 74.6 kW (100 hp) O-200 flat-four. Retired to HAL's museum after 128 hours of flying. Deliveries of initial five production Hansa-3s by NAL began on 20 March 2001. Hansa manufacturing techniques transferred to external agencies, beginning 28 August 2002 when Reinforced Plastics Industries, Bangalore, initiated manufacture of first two composites fuselage shells.

Letter of intent from DGCA for further eight Hansa-3s issued in 2004. Beyond these, any substantial orders are intended to be manufactured by Taneja Aerospace and Aviation Ltd (TAAL) which flew its initial aircraft (VT-HOA) on 3 June 2006. Australian certification also being sought, to assist international marketing. For this, planned modifications by RMIT University's Sir Lawrence Wackett Centre for Aerospace Design Technology will replace existing landing gear by all-composites units, expected to reduce empty weight by about 15 kg (33 lb).

CURRENT VERSIONS: **Hansa-2:** Prototype in original configuration.

Hansa-2RE: Prototype (VT-XIW) re-engined with 93 kW (125 hp) IO-240B; span increased and flaps added; first flight 26 January 1996.

Hansa-3: Production-standard version of Hansa-2RE, first flown (VT-XAL; designated Hansa-3I) on 25 November 1996. First flight with Rotax 914 F3 engine, 9 May 1998, made by second (and lighter) prototype VT-XBL (designated Hansa-3II); provisional JAR-VLA certification awarded to 'XBL' in December 1998 in day VFR category; re-registered VT-HBL later. Current version (c/n 001 prototype VT-HNS) has lightning protection for night operations; made first flight 14 May 1999 and received DGCA certification on 1 February 2000 under FAR Pt 23, Amendment 23-42 (JAR-VLA night operation requirements). VT-XBL and first five production aircraft had flown more than 1,920 hours by June 2004.

Following description applies to this version.

Hansa-S: Four-seat version with raised rear decking and winglets; previously known as Hansa-4, powered by 123 kW (165 hp) SMA SR305-230 or Thielert diesel; project initiated 2002 and model shown at Asian Aerospace, Singapore, February 2004. Changes include winglets and enlarged horizontal tail. NAL hoping to begin prototype in second half of 2005, but not reported by mid-2006.

CUSTOMERS: Four prototypes, including Hansa-2 VT-XIW, of which VT-HNS handed over on 22 March 2002 for use by Department of Aerospace Engineering, IIT Kanpur, although not delivered to Kanpur until 18 April 2003; has non-standard engine cowling and although marked as "Hansa 3" is referred to as Hansa IIT-K.

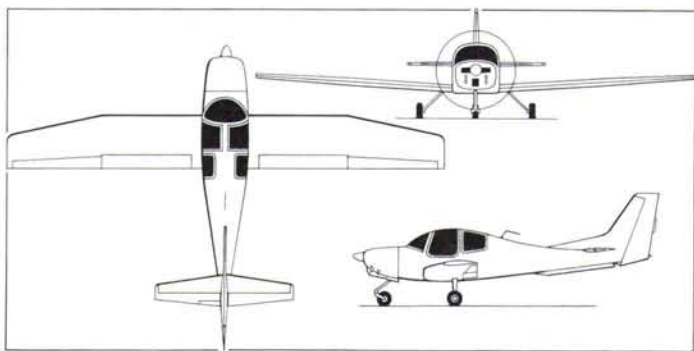
Three Hansa-3s ordered by DGCA for Indian flying clubs (c/n 002, 003 and 004: VH-HNT, 'HNU' and 'HNV'), of which first (maiden flight 10 March 2001) handed over to DGCA on 20 March 2001, then presented to Andhra Pradesh Aviation Academy on 12 April 2001 and delivered to Hyderabad on 8 May 2001. Second and third to DGCA on 22 March 2002, of which 'NU' (first flight 15 January 2002) to Kerala Aviation Training Centre at Trivandrum and 'NV' (first flight 8 March 2002) to Madhya Pradesh Flying Club at Indore on 12 June 2002. Fourth Hansa-3 (c/n 005: VH-HNW) flown 30 March 2003; to DGCA 14 July 2003 for Kerala Aviation Training Centre at Trivandrum. Fifth aircraft (c/n 006: VH-HNX) registered to National Aerospace Laboratory at Bangalore 11 May 2003; delivered to Haryana Institute of Civil Aviation at Karnal 27 October 2004. Further two (VT-HNY and 'HNZ') formally presented on 30 June 2006 to Bangalore Flying School and Andhra Pradesh Aviation Academy, respectively. Additional three (VT-HOA to 'HOC') registered by March 2006, comprising one for Madras Flying Club (VT-HOC) and two ('HOA' and 'HOB') initial production machines from TAAL assembly line.

COSTS: Programme development USD40 million (1997); standard aircraft INR4.5 million (2001).



Hansa 'IIT-K' of Indian Institute of Technology's Flight Laboratory at Kanpur, marked as a Hansa-3

1159033



NAL Hansa-3 (Mike Keep)

0121113

DESIGN FEATURES: Docile handling qualities for *ab initio* training; robust construction and low acquisition/operating cost. Low-wing monoplane with circular-section waisted fuselage; outer wings tapered on leading-edges, with unswept trailing-edge; sweptback fin and rudder; shallow ventral strake; conventional unswept, straight-tapered horizontal tail surfaces.

Laminar-flow wing, with NASA LS(1)-0415 aerofoil section on constant-chord inboard portion, linearly tapered to LS(1)-0413 from there to tip; sweepback 12° 18' 36" on outer leading-edges; dihedral 4° from roots; incidence 0°; twist 0° between root and kink; washout -2° between kink and tip.

FLYING CONTROLS: Conventional and manual. Frise ailerons (100 per cent internal mass balance); horn-balanced plain elevators and large rudder, all actuated by pushrods; pitch trim by electrically operated tab in port elevator. Single-slotted Fowler flaps, deflection 20°.

STRUCTURE: Built primarily of composites (GFRP reinforced epoxy except for carbon fibre main spar) with hand-laid, vacuum-bagged, room temperature-cured sandwich shells; components are post-cured before assembly. Conventional rib and three-spar wings, with moulded sandwich shell and PVC foam core; two-spar tail surfaces similar. Fuselage is also a moulded sandwich shell with PVC foam core.

LANDING GEAR: Non-retractable tricycle type, with wing-mounted cantilever spring steel mainwheel legs and steerable (±33°) trailing-link nosewheel. Cleveland wheels and McCreary tyres (main 6.00-6, nose 5.00-5), pressure 2.07 bar (30 lb/sq in) on all units. Cleveland hydraulic disc brakes. Minimum ground turning radius 2.64 m (8 ft 8 in).

POWER PLANT: One 84.6 kW (113.4 hp at 5,800 rpm) Rotax 914 F3 turbocharged flat-four engine; Hoffmann NOV 352FQ+8 two-blade constant-speed propeller. Single composites fuel tank aft of cockpit, usable capacity 85 litres (22.5 US gallons; 18.7 Imp gallons). Single gravity refuelling point on top of fuselage, port side. Oil capacity 3 litres (0.8 US gallon; 0.7 Imp gallon).

ACCOMMODATION: Two seats side by side; dual controls standard. Upward-opening gullwing doors. Baggage compartment aft of pilot's seat.

SYSTEMS: Manual (toe-operated) hydraulic mainwheel brakes. Electrical (DC) system powered by 14 V, 40 A generator and 12 V, 18 Ah Gill G25M lead-acid battery.

AVIONICS: Comms: Bendix/King KLX 125 combined VHF/VOR com/nav unit with concealed foil antennas; ACK Technologies E-01 ELT; Clark intercom.

Flight: Optional GPS.

Instrumentation: Conventional VFR (IFR version planned). For day operations: ASI, VSI, altimeter, magnetic compass, slip/skid indicator and OAT gauge. For night operations: artificial horizon, directional gyro, turn co-ordinator, navigation lights, landing lights, anti-collision lights, panel and map lights.

DIMENSIONS, EXTERNAL:

Wing span	10.47 m (34 ft 4 1/4 in)
Wing chord: at root	1.30 m (4 ft 3 3/4 in)
at tip	0.80 m (2 ft 7 1/2 in)
Wing aspect ratio	8.8
Length overall	7.66 m (25 ft 1 1/2 in)
Fuselage max width	1.13 m (3 ft 8 1/2 in)
Height overall	2.615 m (8 ft 7 in)
Tailplane span	3.60 m (11 ft 9 3/4 in)
Wheel track	2.20 m (7 ft 2 1/2 in)
Wheelbase	1.95 m (6 ft 4 3/4 in)
Propeller diameter	1.70 m (5 ft 7 in)
Propeller ground clearance	0.33 m (1 ft 1 in)

DIMENSIONS, INTERNAL:

Cockpit: Length	2.15 m (7 ft 0 3/4 in)
Max width	1.07 m (3 ft 6 1/4 in)
Max height	1.00 m (3 ft 3 3/4 in)
Floor area	0.96 m² (10.3 sq ft)
Volume	1.4 m³ (49.9 cu ft)
Baggage compartment volume	0.24 m³ (8.5 cu ft)

AREAS:

Wings, gross	12.47 m² (134.2 sq ft)
Ailerons (total)	0.97 m² (10.44 sq ft)
Flaps (total)	1.515 m² (16.31 sq ft)
Fin	0.75 m² (8.07 sq ft)
Rudder	0.70 m² (7.53 sq ft)
Tailplane	1.19 m² (12.81 sq ft)
Elevators (total, incl tab)	0.85 m² (9.15 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: normal	485 kg (1,069 lb)
night operations	545 kg (1,202 lb)
Max fuel weight	65 kg (143 lb)
Max T-O and landing weight	750 kg (1,653 lb)
Max wing loading	60.1 kg/m² (12.32 lb/sq ft)
Max power loading	8.87 kg/kW (14.57 lb/hp)

PERFORMANCE:

Max cruising speed at FL100	115 kt (213 km/h; 132 mph)
Stalling speed, flaps down	48 kt (89 km/h; 56 mph) IAS
Max rate of climb at S/L	198 m (650 ft)/min
T-O run	413 m (1,355 ft)
T-O to 15 m (50 ft)	450 m (1,480 ft)
Landing from 15 m (50 ft)	600 m (1,970 ft)
Landing run	540 m (1,775 ft)
Range with max fuel	455 n miles (842 km; 523 miles)
Endurance	4 h

RAJ HAMSA

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Web: www.randkar.fr Company was founded at Pondicherry in 1980, initially building hang

gliders; powered hang gliders introduced 1983 and X-Air range 10 years later. Currently also markets Mosquito, Javelin and Racer hang gliders and Clipper and Voyager powered hang gliders. Company has built over 1,000 aircraft.

RAJ HAMSA X-AIR

TYPE: Side-by-side ultralight kitbuilt.

PROGRAMME: Launched 1993 as development of US Weedhopper; has BCAR Section S certification.

CURRENT VERSIONS: **X-Air:** Baseline version; wing span 9.80 m (32 ft 1 3/4 in); area 16.00 m² (172.2 sq ft). Available as **X-Air 502T** (Rotax 503 engine '50 horsepower, two-stroke'), **X-Air 602T** (Rotax 582 '60 horsepower, two-stroke'); **X-Air 604T** (44.7 kW; 60 hp HKS 700E); and **X-Air Jabiru** (59.7 kW; 80 hp Jabiru 2200 engine).

X-Air F Gummam: Has more efficient wing, of higher aspect ratio (6.4 instead of 6.0) and fitted with flaps; deeper rear fuselage, providing space for 20 kg (44 lb) of baggage aft of seats; optional auxiliary fuel tank in wing; wire-braced tailplane. Known simply as X-Air F for European and US marketing; or in UK as **Falcon**, latter with Rotax 912 flat-four.

RAJ HAMSA HANUMAN

US marketing name: X-Air H

TYPE: Side-by-side ultralight/kitbuilt.

PROGRAMME: Prototype (82.0 kW; 110 hp Hirth F30 engine and full-span flaperons) complete by July 2001 and immediately shipped to France for test flying by Rand Kar. Debut at Blois Air Show, September 2001. Launched at Paris, 15-22 June 2003, when second of planned six development and demonstrator aircraft was shown. Deliveries from first quarter 2004.

CURRENT VERSIONS: **X-Air H Hanuman 602T**: '60 horsepower, two-stroke' version with Rotax 582 engine.

X-Air H Hanuman 804TJ: Jabiru 2200 engine.

X-Air H Hanuman 912: Rotax 912 engine.

COSTS: In India, INR1,906,700 flyaway, with Jabiru 2200. In Europe, basic kit EUR13,047 (Rotax 582 and Jabiru) or EUR13,237 (Rotax 912); engine and instruments EUR7,950 extra for Rotax 582, EUR15,961 for Rotax 912 or EUR11,760 for Jabiru; flyaway price EUR25,196 (Rotax 582), EUR35,037 (Rotax 912) or EUR29,768 (Jabiru) (all 2006, plus tax).

DESIGN FEATURES: Further development of X-Air/Gumnam, redesigned for even faster kit assembly. High wing with V strut bracing; upward-swept rear fuselage and sweptback fin.

FLYING CONTROLS: Conventional and manual. Plain, three-position flaps, maximum deflection 45°. Ailerons and flaps actuated by pushrods; rudder and elevators by cables. Flight adjustable trim tab on starboard elevator. No aerodynamic balances.

STRUCTURE: Aluminium tube fuselage and wings with Dacron covering, except composites forward fuselage. Wire-braced empennage.

LANDING GEAR: Tricycle type; fixed. Mainwheels and steerable nosewheel all 3.50-8. Bungee cord levered suspension. Cable-actuated mainwheel brakes. Mainwheel speed fairings standard.

POWER PLANT: One 48.0 kW (64.4 hp) water-cooled Rotax 582 two-stroke driving an Arplast EcoProp three-blade, ground-adjustable pitch, composites propeller; or one 59.7 kW (80 hp) air-cooled Jabiru 2200 four-stroke with two-blade composites propeller; or 59.6 kW (79.9 hp) Rotax 912 S air/water-cooled four-stroke with two-blade wooden propeller. Fuel capacity 80 litres (21.1 US gallons; 17.6 Imp gallons).

EQUIPMENT: BRS1050 ballistic recovery parachute optional.

DIMENSIONS, EXTERNAL:

Wing span	10.05 m (32 ft 1 1/4 in)
Length overall	6.09 m (19 ft 1 1/4 in)
Height overall	2.30 m (7 ft 6 1/2 in)

DIMENSIONS, INTERNAL:

Cockpit max width	1.14 m (3 ft 9 in)
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AREAS:

Wings, gross	13.92 m ² (149.8 sq ft)
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WEIGHTS AND LOADINGS:

Basic weight empty, equipped:	
602T	263 kg (580 lb)
804TJ	276 kg (608 lb)
Max T-O weight	450 kg (992 lb)

PERFORMANCE (804TJ):

Never-exceed speed (VNE)	105 kt (195 km/h; 121 mph)
Max level speed	89 kt (165 km/h; 102 mph)
Econ cruising speed	70 kt (130 km/h; 81 mph)
Stalling speed, power off:	
flaps up	34 kt (63 km/h; 40 mph)
25° flap	32 kt (58 km/h; 36 mph)
45° flap	29 kt (53 km/h; 33 mph)
Max rate of climb at S/L	288 m (945 ft)/min
Service ceiling	4,000 m (13,120 ft)
T-O run	80 m (265 ft)
T-O to 15 m (50 ft)	220 m (725 ft)
Landing from 15 m (50 ft)	110 m (360 ft)
Landing run	70 m (230 ft)
g limits	+6/-3

PERFORMANCE, UNPOWERED (804TJ):

Best glide ratio at 49 kt (90 km/h; 56 mph)	9
Min sinking speed	2.50 m (8.20 ft)/s



Raj Hamsa Hanuman, or X-Air H (Paul Jackson)

1159076



Raj Hamsa X-Air in open cockpit form (Paul Jackson)

1159075

Available as **X-Air F 502T**, **602T**, or **804TJ** with Jabiru engine.

CUSTOMERS: More than 900 kits produced by January 2004.

DESCRIPTION applies to X-Air F, except where indicated.

COSTS: In India, flyaway, INR1,415,900 for X-Air with Rotax 582; INR1,497,000 for Gumnam (Rotax 582) and INR1,767,900 for Gumnam (Jabiru). In Europe, basic X-Air F airframe kit EUR10,676 (or EUR11,261 optimised for Jabiru), plus EUR323 for engine instruments (EUR416 for Jabiru), EUR727 for flight instruments and either EUR3,980 (Rotax 503), EUR5,546 (Rotax 582), EUR7,191 (Rotax 582 with silencers and electric starter) or EUR10,534 (Jabiru 2200) for engine (all plus tax, 2006).

Original X-Air remains available, with airframe kits at EUR9,300 (502T, 602T), EUR9,604 (604T/HKS) and EUR9,885 (Jabiru), plus add-ons as for X-Air F (all excluding tax, 2006).

DESIGN FEATURES: High-wing monoplane with sweptback leading-edges and wing-mounted engine. Quick-build kit (quoted build time only 40 hours). Potential applications include basic training, crop-spraying, aerial observation and surveillance.

Wing section NACA 4412. Sweepback 8°; dihedral 1° 12'; washout 4°.

FLYING CONTROLS: Conventional and manual. Differential ailerons; fixed tab on port elevator. All control surfaces non-balanced. Flaps; maximum deflection 25°.

STRUCTURE: Aluminium alloy subframe, with composites nose module; rear fuselage, wings and tail surfaces fabric-covered. Braced wings (V struts); tailplane strut-braced on X-Air, wire-braced on X-Air F/Gumnam. Lexan doors optional.

LANDING GEAR: Tricycle type, fixed; two side Vs hinged to lower longerons, plus half-axles; shock-absorbers on all three units. Mainwheel drum brakes; nosewheel steerable by rudder pedals. All tyres 350x80. Optional mainwheel speed fairings (standard on Gumnam) and nosewheel guard. Small tailskid at base of fin. Can be equipped with Puddlejumper floats.

POWER PLANT: **X-Air F 502T**: One 37.0 kW (49.6 hp) Rotax 503 UL-2V air-cooled two-stroke driving a two-blade, wooden propeller.

X-Air F 602T: One 47.8 kW (64.1 hp) Rotax 582 UL water-cooled two-stroke driving a two-blade wooden, or three-blade composites, propeller.

X-Air F 804TJ: One 59.7 kW (80 hp) Jabiru 2200 air-cooled four-stroke driving a two-blade, composites propeller.

Fuel in two tanks aft of seats, combined capacity 50 litres (13.2 US gallons; 11.0 Imp gallons); auxiliary wing tank optional.

EQUIPMENT: Ballistic recovery parachute optional.

DIMENSIONS, EXTERNAL:

Wing span	9.40 m (30 ft 10 in)
Length overall	5.65 m (18 ft 6 1/2 in)
Height overall	2.55 m (8 ft 4 1/2 in)

DIMENSIONS, INTERNAL:

Cabin max width	1.16 m (3 ft 9 1/4 in)
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AREAS:

Wings, gross	14.32 m ² (154.1 sq ft)
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WEIGHTS AND LOADINGS:

Basic weight empty: 502T	230 kg (507 lb)
602T	237 kg (522 lb)
804TJ	262 kg (578 lb)
Max T-O weight	450 kg (992 lb)

PERFORMANCE, POWERED (804TJ):

Never-exceed speed (VNE)	83 kt (155 km/h; 96 mph)
Max level speed at S/L	78 kt (145 km/h; 90 mph)
Econ cruising speed at S/L	59 kt (110 km/h; 68 mph)
Stalling speed: flaps up	27 kt (50 km/h; 32 mph)
25° flap	24 kt (43 km/h; 27 mph)
Max rate of climb at S/L	288 m (945 ft)/min
Service ceiling	4,000 m (13,120 ft)
T-O run	80 m (265 ft)
T-O to 15 m (50 ft)	220 m (725 ft)
Landing from 15 m (50 ft)	110 m (360 ft)
Landing run	70 m (230 ft)
Endurance at cruising speed, standard fuel	more than 3 h
g limits	+6/-3

PERFORMANCE, UNPOWERED (804TJ):

Best glide ratio at 35 kt (64 km/h; 40 mph)	7
Min sinking speed	2.50 m (8.20 ft)/s

TAAL

TANEJA AEROSPACE AND AVIATION LTD

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e-mail: taal@vsnl.com

Web: www.taal.co.in

CHAIRMAN: Khushroo Rustumji

MANAGING DIRECTOR: Salil Taneja

JOINT MANAGING DIRECTOR: Prashant Gurha

DEPUTY GENERAL MANAGER, AIRCRAFT SALES: Santosh Deshpande

TAAL is part of Indian Seamless Metal Tubes Group; has modern plant on 89 ha (220 acre)

site at Hosur, near Bangalore, with 1,300 m (4,265 ft) captive runway (being extended to 2,286 m; 7,500 ft in 2006), hangars, laboratories, paint shops and other facilities for aircraft manufacture and overhaul. Entered into technical agreement second quarter 1992 with Partenavia of Italy to produce P.68C/TC, P.68 Observer and AP.68TP-600 Viator light twins in India. Second Viator delivered to South African customer in March 2003, but no other recent evidence of any output. More recently, TAAL received kits of about 10 Sport E lightplanes (current incarnation of former Thorp T-211) from IndUS Aviation of Dallas, Texas, and had begun assembly of first two by end of 2003, with first delivery then scheduled for March 2004. Indian parts manufacture was expected to begin three months later.

TAAL is also active in air taxi operations with fleet of 11 P.68Cs; manufactures Nishant UAVs for Aeronautical Development Establishment and structural parts for space launchers; and plans to enter MRO business area, with new narrow-body hangar due to open in May 2006.

Indonesia

DIRGANTARA

PT DIRGANTARA INDONESIA (INDONESIAN AEROSPACE)

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VICE-PRESIDENT: Rudhy M Mokobombang

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Mohamad Mochajan (Technology)

Budi Wuraskito (Operation and Production)

Muhammad Nuril Fuad (General Affairs)

Rudhy M Mokobombang (Finance)

GENERAL MANAGERS:

Arie Wibowo (Aircraft)

Budiman Saleh (Aerostructures)

Dita Ardoni Jafri (Aircraft Services)

Muhammad Fikri (Engineering Services)

Agus Eddy Pranoto (Defence)

VICE-PRESIDENT AND CORPORATE SECRETARY: Mochtar Sharief

PUBLIC RELATIONS MANAGER: Yusuf Abdurachman

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Originally formed by Indonesian government as PT (Perusahaan Terbatas Industri Pesawat Terbang Nurtanio (Nurtanio Aircraft Industry Ltd) 23 August 1976 to centralise all aerospace facilities in one company; renamed PT Industri Pesawat Terbang Nusantara (IPTN) 11 October 1985. Company restructured in January 2000, with PT Bahana Pengelola Industri Strategis as major shareholder, becoming limited liability company (PT Persero) with nine strategic business units, six (now four) profit centres, four resource centres and six subsidiaries/corporate functions.

New name PT Dirgantara Indonesia (internationally, Indonesian Aerospace, or IAE) inaugurated 24 August 2000 (start of company's 25th year of existence). Site area is 87 ha (215 acres) including 600,000 m² (6,458,350 sq ft) covered area. Workforce in July 2003 was 9,600, including 2,500 engineers and 5,000 technicians and operators, compared with some 9,500 in early 2002; reduced to 3,720 by 2004. Former 18 business units now consolidated into five, as follows:

Aircraft co-manufactures Airtech CN-235 Series 200/220, produces NC-212 Series 200 under licence from EADS CASA of Spain, and NA5-332 Super Puma under licence from Eurocopter. One NC-212-200 delivered to Indonesian Army 3 January 2005 and one (in maritime patrol configuration) to Indonesian Marine Corps on 12 May 2005. As at February 2006, backlog of these two types was reported to be three NC-212-200s for the Indonesian Navy and the final seven of 16 NAS-332s for the Indonesian Army. Earlier programmes included manufacture of NBO-105 helicopters under Eurocopter licence, and NBell-412 under licence from Bell.

Two CN-235s delivered to South Korea in December 2001 and six more by end of 2002. Pakistan Air Force ordered four and Royal Malaysian Air Force two; those for PAF handed over in 2004 (28 January, September and 3 December) and 2005 (6 June); those for RMAF 9 August 2005 and 14 February 2006. Ten ordered by Thailand in December 2005 (six for Air Force and four for Ministry of Agriculture). Agreement 19 June 1991 with BAe (now BAE Systems) to collaborate on production and assembly of Hawks for Indonesian Air Force, although all were assembled in UK with Indonesia receiving offset work. In January 2006, EADS CASA agreed to extend manufacturing licence to include Series 400 C-212. Earlier, Dirgantara had received a seven-year, USD45 million contract from EADS CASA to supply nose, centre and rear fuselage components for the Spanish C-295 production line.

New five-year business plan for Dirgantara in late 2003 envisaged development, possibly as joint ventures with other Southeast Asian partners, of a 19-passenger transport (N-219) and a new light helicopter. Feasibility of former under discussion with CTRM (Malaysia) in early 2004, as well as a larger (up to 50 passengers) turboprop twin. At that time, licensed assembly of Polish SW-4 being examined as possible future helicopter venture. No further news of N-219 by early 2005; however, contract announced at that time for international development of NMX-1 six-passenger jet with AeroNimbus of Malaysia.

Aircraft Services undertakes maintenance, repair, overhaul and modification.

Aerostructures subcontract work includes production of components for Boeing (737/777), Bombardier (Global Express and Global 5000) and Airbus (A320/321/330/340/380); first A380 deliveries 28 April 2003. Company's 1,400 m² (15,070 sq ft) gas-turbine maintenance centre can maintain, overhaul and repair Rolls-Royce 250, P&W JT8D, P&W PT6T-3/3B, R-R Dart RDa.7, Honeywell LTS101 and TPE331 and General Electric CT7 engines, plus some components of Allison T56 and R-R Tay.

Engineering Services is responsible for communication and simulation technologies, information technology solutions and design centre.

Defence is concerned principally with naval and other non-aviation work.

International

AGUSTAWESTLAND

(A FINMECCANICA COMPANY)

Web: www.agustawestland.com

CHAIRMAN: Kevin Smith

CEO: Amedeo Caporaletti

MANAGING DIRECTOR: Richard Case

COOS:

A Gustapane (Italy)

A Johnson (UK)

MARKETING MANAGER: G Orsi

PUBLIC RELATIONS MANAGERS:

Gianluca Grimaldi (Italy)

David Bath (UK)

MoU covering joint merger of helicopter divisions signed by Finmeccanica of Italy and GKN of UK on 16 April 1998; heads of agreement 18 March 1999; details finalised (subject to regulatory approval) and name AgustaWestland announced 26 July 2000; company declared fully operational 12 February 2000.

Westland also contributed its 50 per cent share in EH101, GKN's aerospace transmissions business and 50 per cent share in Aviation Training International (joint venture with Boeing to support British Army WAH-64 Apaches). Agusta also contributed half of EH 101, transmissions and aerostructures business and own shares in NH90 (32 per cent) and Bell/Agusta (45 per cent). Workforce in 2005 was 8,968.

Fundamental change announced 26 May 2004 upon GKN's agreement to sell its 50 per cent share in Finmeccanica for £1.065 million, with AgustaWestland becoming wholly Italian-owned. In December 2005, AgustaWestland acquired the AB 139 helicopter formerly developed jointly with Bell; 45 per cent share of Bell/Agusta to be retained through increase of investment in BA609 tiltrotor. AB 139 became AW 139 in February 2005, this designation prefix to be used for all new projects.

Together, the two companies have built over 7,100 helicopters for customers in more than 80 countries. Turnover in 2004 was EUR2,542 million and 2005 backlog valued at EUR5,238 million. Delivered 66 commercial and 26 military helicopters in 2004.

AgustaWestland owns 100 per cent of both Agusta SpA and Westland Holdings Ltd, latter comprising Westland Helicopters Ltd and Westland Transmissions Ltd. Subsidiaries are as follows.

Agusta SpA

AgustaWestland Inc (USA) (50 per cent)

Agusta Aerospace Corporation (USA)

Agusta Aerospace Services BV (Belgium)

AgustaWestland International Ltd (50 per cent)

Bell/Agusta Aerospace Company (USA) (50 per cent)

NHI srl (32 per cent)

other subsidiaries and holdings

Westland Helicopters Ltd

AgustaWestland Inc (USA) (50 per cent)

AgustaWestland International Ltd (50 per cent)

Aviation Training International Ltd (50 per cent)

other subsidiaries and holdings.

On 31 October 2001, AgustaWestland initiated a joint marketing effort with Lockheed Martin, under which the latter promotes a US market version of the EHI EH101, known as the US101. In January 2005 this was purchased for US Presidential use as VH-71 Kestrel.

Agusta and Westland products are marketed under the AgustaWestland name, but helicopter type certificate ownership (and thus civil register entries) remains unaltered. The Bell/Agusta partnership does not involve Westland.

Agusta

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CHAIRMAN AND CEO: Amedeo Caporaletti

VICE-PRESIDENT, EXTERNAL RELATIONS AND COMMUNICATIONS: Gian Luigi Ghez

GENERAL MANAGER: Giuseppe Orsi

Original Agusta company established 1907 by Giovanni Agusta; acquired licence for Bell 47 in 1952; first flight of first Agusta example 22 May 1954; later produced Bell 204, 205, 206 and 212; Bell AB 412 still in low-volume production; also produced various versions of Sikorsky S-61 under licence; participates in NH90 programme. Own designs include A 109 multirole helicopter, A 119 Koala, A 129 anti-tank helicopter, AW 139 and military AW 149 utility helicopters.

Agusta group completely reorganised from 1 January 1981 under new holding company Agusta; became part of Italian public holding company EFIM, but integrated into Finmeccanica on 20 December 1996.

Manufacturing plants in Italy comprise Cascina Costa (HQ and transmissions), Vergiate (final assembly), Anagni/Frosinone (composites and rotor heads), Benevento (castings) and Brindisi (aerostructures).

In November 1998 Agusta and Bell Helicopter Textron signed an agreement to form Bell/Agusta Aerospace Company, to share development, manufacture and marketing of the Bell/Agusta BA609 civil tiltrotor and AB139 utility helicopter, the latter being removed from the agreement in 2005 and becoming an AgustaWestland programme as AW 139.

On 14 January 2002, Agusta and Denel Group of South Africa signed an agreement for licensed production of the A 109 and A 119 in South Africa. Under the terms of the agreement Denel is manufacturing the helicopters at its Kempton Park facility for marketing in Africa, the Middle East, South America and Southeast Asia. Denel building 25 of the 30 A 109s ordered by the South African Air Force.

Westland

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CEO: Richard Case

Westland Aircraft Ltd (later expanded to Westland Group plc) formed July 1935, taking over aircraft branch of Petters Ltd (known previously as Westland Aircraft Works) that had designed/built aircraft since 1915; entered helicopter industry having acquired licence to build US Sikorsky S-51 as Dragonfly 1947.

GKN shareholding in Westland Group progressively increased until overall control achieved on 18 April 1994.

Westland Helicopters Ltd included GKN Westland Industrial Products Ltd and had 50 per cent interest in Aerosystems International Ltd at Yeovil (aerospace software; partnership with BAE Systems) and EH Industries Ltd.

Under June 1989 agreement with former McDonnell Douglas, Westland obtained co-production rights for Boeing AH-64 Apache; this selected for British Army Air Corps, July 1995; Westland is prime contractor to UK MoD. Production undertaken in newly built 5,200 m² (56,000 sq ft) assembly hall at Yeovil, opened 14 January 1999. Deliveries completed in 2004.

Aviation Training International (ATI) joint venture company formed with Boeing on 3 August 1998 to provide air, ground and maintenance crews for British Army Apaches under £650 million, 30 year contract; began operations 29 July 1999 at Sherborne HQ; has branches at Middle Wallop, Dishforth and Wattisham flying bases, plus engineering school at Arborfield.

AgustaWestland International Ltd (AWIL)

EH Industries (European Helicopter Industries) formed June 1980 by Westland Helicopters and Agusta (50 per cent each), to undertake joint development of new anti-submarine warfare helicopter for Royal Navy and Italian Navy. Programme handled on behalf of both governments by UK Ministry of Defence; Westland allocated design leadership for commercial version, Agusta for rear-loading military/utility version; naval version developed jointly for UK and Italian navies and export. IBM Federal Systems (now Lockheed Martin Aerospace Systems Integration Corporation) selected to manage Royal Navy programme in 1991, overseeing and taking responsibility for RN-specific development activity, systems integration and aircraft production and delivery.

Kawasaki of Japan, in conjunction with trading company Okura, signed an agreement in June 1995 for joint marketing and support of the EH101 as KHI-01, this to include local assembly.

On 19 March 2004, EHI Ltd was renamed AgustaWestland International Ltd upon official opening of new headquarters at Farnborough, UK.

AGUSTAWESTLAND LYNX

TYPE: Light utility helicopter.

PROGRAMME: Developed within Anglo-French helicopter agreement confirmed 2 April 1968; Westland given design leadership; first flight of first of 13 prototypes (XW835) 21 March 1971; first flight of fourth prototype (XW838) 9 March 1972, featuring production-type monobloc rotor head; first flights of British Army Lynx prototype (XX153) 12 April 1972, French Navy prototype (XX904) 6 July 1973, production Lynx (RN HAS, Mk 2 XZ229) 20 February 1976; first RN operational unit (No. 702 Squadron) formed on completion of intensive flight trials December 1977; AH, Mk 5 first flew (ZE375) 23 February 1985; other development details and records in 1975-76 and subsequent *Jane's*, Production shared 70 per cent Westland, 30 per cent Aerospatiale.

Second phase of development was Super Lynx (naval) and Battlefield Lynx, to which standards later UK military Lynx (Mks 8 and 9) were built; also exported, Battlefield Lynx mockup displayed at 1988 Farnborough Air Show (converted demonstrator G-I LYNX), featuring wheeled landing gear, exhaust diffusers and provision for anti-helicopter missiles each side of fuselage; first flight of wheeled prototype (converted trials AH, Mk 7 XZ170) 29 November 1989; first flight of South Korean Super Lynx (90-0701, temporarily ZH219) 16 November 1989 (also first Lynx with Seaspray Mk 3 radar); first flight of Portuguese Super Lynx (9201, temporarily ZH580, ex-RN ZE559) 27 March 1992.

In September 1996, GKN Westland formally launched versions of Lynx powered by CTS800 turboshafts, with or without a Six-screen EFIS. Current production versions were simultaneously redesignated, those now on offer being Srs 100, 200 or 300. Fuselages built from 1999 have potential for MTOW extension to 5,443 kg (12,000 lb) and beyond. First Super Lynx 300 (ZT800) flew 27 January 1999, although maiden flight with CTS800 engine was on 12 June 2001.

Potential life extension for Lynx possible following 30 January 2002 award to Westland of £20+ million, 18-month study contract expected to lead to upgrade of 80 British Army Mk 7 and Mk 9 Lynxes under Future Lynx Battlefield Light Utility Helicopter programme at total cost of £1 billion. This followed, on 22 July 2002, by announcement of assessment phase for Future Lynx to meet Royal Navy's Surface Combatant Maritime Rotorcraft requirement, requiring upgrade of 40 Lynx to enter service from 2008.

UK MoD decision to proceed with Future Lynx announced 24 March 2005, £1,000 million programme involving both army and navy versions. Agreement also includes exploration of potential partnership between AgustaWestland and MoD for both support of existing military helicopter fleet and future requirements.

CURRENT VERSIONS: Early versions of Lynx for UK armed forces were last described in the 2002 03 *Jane's All the World's Aircraft*. Those for overseas operators appeared in the 1990-01 and earlier editions.

Super Lynx Series 100: Introduced September 1996; export version of HMA, Mk 8; conventional cockpit instrumentation, Rolls-Royce Gem 42-1 turboshafts and 360° radar. Applies retrospectively to aircraft sold to Brazil (Mk 21A), Portugal (Mk 95) and South Korea (Mk 99) as well as to seven Mk 88As sold to Germany, also in September 1996.



Artist's impression of Future Lynx in maritime form for Royal Navy

1151714



AgustaWestland Lynx Srs 300 Mk 110 of Thai Navy

1151712



Future Lynx in British Army form, shown in an artist's impression

115173



AgustaWestland Lynx HMA Mk 8, based on the Super Lynx advanced export version (Dennis Punnett)

0507240

Super Lynx Series 200: Conventional cockpit, but electronic power system displays and two LHTEC CTS800-4N turboshafts with FADEC. Original Lynx demonstrator G-LYNX fitted with two 1,007 kW (1,350 shp) T800 turboshafts as **Battlefield Lynx 800** private venture (LHTEC funding power plants and gearboxes, Westland provided airframe for full flight demonstration programme); first flight 25 September 1991; programme terminated early 1992 after 17 hours. CTS800 is derived from the T800 (as in the Boeing Sikorsky RAH-66 Comanche) and offers an additional 30 per cent of power to operators using the Lynx in hot climates. Version for production Lynx is CTS800-4N.

Super Lynx Series 300: Prototype first flown (ZT800) 27 January 1999, initially with Gem 42 engines; flew with CTS800-4N engines 12 June 2001. Six-screen EFIS cockpit (including four 158 mm; 6¼ in square integrated display units); dual redundant MIL-STD-1553B and ARINC 429 databuses; new navigation system and AHRS; revised communications suite; CTS800 engines. Ordered by Malaysia (with Sea Skua anti-ship missiles); Thailand confirmed contract for two in 2001; Oman announced intention to purchase on 17 March 2001 and signed contract for 16 on 19 January 2002; aircraft equipment includes Avionics EW suite.

South Africa, announced intention to purchase on 18 November 1998, but later deferred expected contract for four to unspecified date; authorisation to proceed given February 2003; contract confirmation announced 14 August 2003; South African Srs 300s will be designated Mk 64 and equipped with Telephonics AN/APS-143(V)-3 radar, Sysdel Sea Raven 118 ESM, Kentron Cumulus LEO Mk 2 sensor turret with video datalink, Grintek GUS-1000 communications system (two Reutech ACR-500 V/UHF and one Grintek AT-2820 HF) and Tellumat PT-200 IFF.

Future Lynx: Development of Series 300; offered to UK armed forces as retrofit meeting Army's Battlefield Light Utility Helicopter and Navy's Surface Combatant Maritime Rotorcraft requirements. Growth potential to MTOW of 6,250 kg (13,778 lb). By early 2005, Future Lynx design refined to incorporate flat-sided tailboom with horizontal stabiliser having fins at tip.

CUSTOMERS: Refer to table. Contracts for later versions include Super Lynx ordered by South Korea 1988 (12 Mk 99 with Racal Avionics Doppler 71/TANS N nav system, Seaspray Mk 3 360° radar, AN/AQS-18 dipping sonar and Sea Skua), handed over between 26 July 1990 and May 1991 for 'Sumner' and 'Gearing' class destroyers; further 13 delivered 1999-2000 as Mk 99As to order confirmed in June 1997. Mk 99A has composite tailplane; first aircraft flown 3 July 1999 and departed Yeovil for surface delivery 1 September 1999. Portugal ordered five (first two ex-Royal Navy modified airframes) Super Lynx Mk 95 1990 (plus three options) with Racal RNS252 GPS-aided INS and Doppler 91 navigation systems and some US equipment including AN/AQS-18 sonar and Honeywell RDR 1500 radar; first two handed over 29 July 1993 for 'Vasco da Gama' class (MEKO 200) frigates; final two delivered 16 November 1993. Brazil ordered nine Mk 21As (plus five conversions from Mk 21). First for upgrade, N3027 delivered to Yeovil on 1 February 1995 and reflown as Mk 21A (N4010) on 22 December 1995; last two redelivered in late April 1998. First new-build helicopter (N4001) flew 12 June 1996; last delivered in August 1997. Mk 21A avionics include 360° Seaspray 3000 radar, RNS252 INS and Doppler 71 (but no FLIR or CTS); armament includes Sea Skua missiles. Mk 21A introduced 5,330 kg (11,750 lb) MTOW.

German Navy ordered seven Super Lynx Mk 88As in September 1996 and simultaneously took an option (confirmed on 25 June 1998) on upgrading (with new-build airframes) of its existing 17 (subsequently reduced by attrition to 15); new deliveries began with roll-out on 14 July 1999 (post first flight) of initial aircraft. Westland converted initial upgraded helicopter (8303), first flown 28 February 2001. First of 14 upgrades by Eurocopter at Donauwörth (of 8309) was redelivered on 7 March 2002. Mk 88A is a Srs 100 aircraft with 360° Seaspray Mk 3000 radar, FLIR turret (or nose fairing when not fitted), Rockwell Collins GPS and Racal Doppler 91 and RNS252; Sea Skua ASM armament.

Eight Danish aircraft upgraded to Mk 90B by 2004 with new airframes under contract announced 20 January 1998; all except one undertaken locally; initial conversion (S-191) by Westland and redelivered to Denmark on 1 November 2000; eighth entered re-work in June 2004. Super Lynx also offered to Australia and New Zealand (both unsuccessfully) and Malaysia, last-mentioned announcing order for six Mk 100s on 7 September 1999;

deliveries began mid-2003; first flight in Malaysia was on 21 July 2003; final aircraft (No. 3) delayed in UK until mid-2004 for Sea Skua anti-ship missile trials and formally handed-over at Farnborough International on 19 July 2004.

Oman's first Lynx Mk 120 flew 25 October 2003; first three delivered on 24 June 2004, although formal acceptance (sixth aircraft) not effected until 19 July 2004 in ceremony at Farnborough International. Are first Lynx with new-generation HUMS and related maintenance data transfer device. Manufacture complete by mid-2005.

COSTS: £100 million for seven Mk 88As (Germany), 1996. Proposed four Srs 300s for South Africa estimated to cost total of £80 million (1998). Two Thai Lynx 300s, plus logistic support and services, £25 million (2001). Six Malaysian Lynx 300s valued at RM700 million (US\$184 million) (1999).

DESIGN FEATURES: Compact design suited to hunter-killer ASW and missile-armed anti-ship naval roles from frigates or larger ships (superseding ship-guided helicopters), armed/unarmed land roles with cabin large enough for squad, or other tasks; manually folding tail pylon on most (but not all) naval versions; single four-blade semi-rigid main rotor (foldable), each blade attached to main rotor hub by titanium rotor plates and flexible arm; rotor drives taken from front of engines into main gearbox mounted above cabin ahead of engines; in flight, accessory gears (at front of main gearbox) driven by one of two through shafts from first stage reduction gears; four-blade tail rotor, drive taken from main ring gear; single large window in each main cabin sliding door; provision for internally mounted armament, and for exterior universal flange mounting each side for other weapons/stores. Super Lynx has all-weather day/night capability; extended payload/range; advanced technology swept-tip (BERP) composites main rotor blades offering improved speed and aerodynamic efficiency and reduced vibration; and reversed direction tail rotor for improved control.

FLYING CONTROLS: Rotor head controls actuated by three identical tandem servo-jacks and powered by two independent hydraulic systems; control system incorporates simple stability augmentation system; each engine embodies independent control system providing full-authority rotor speed governing, pilot control being limited to selection of desired rotor speed range; in event of one engine failure, system restores power up to single-engine maximum contingency rating; main rotor can provide negative thrust to increase stability on deck after touchdown on naval versions; hydraulically operated rotor brake mounted on main gearbox; sweptback fin/tail rotor pylon, with starboard half-tailplane.

STRUCTURE: Conventional semi-monocoque pod and boom, mainly light alloy; glass fibre access panels, doors, fairings, pylon leading/trailing-edges, and bullet fairing over tail rotor gearbox; composites main rotor blades; main rotor hub and inboard flexible arm portions built as complete unit, as titanium monobloc forging; tail rotor blades have light alloy spar, stainless steel leading-edge sheath and rear section as for main blades.

LANDING GEAR (general purpose military version): non-retractable tubular skid type. Provision for a pair of adjustable ground handling wheels on each skid. Flotation gear optional. Battlefield Lynx and AH, Mk 9 equivalent have non-retractable tricycle gear with twin nosewheels.

LANDING GEAR (naval versions): non-retractable oleo-pneumatic tricycle type. Single-wheel main units, carried on sponsons, fixed at 27° toe-out for deck landing; can be manually turned into line and locked fore and aft for movement of aircraft into and out of ship's hangar. Twin-wheel nose unit steered hydraulically through 90° by the pilot to facilitate independent take-off into wind. Sprag brakes (wheel locks) fitted to each wheel prevent rotation on landing or inadvertent deck roll. These locks disengage hydraulically and re-engage automatically in event of hydraulic failure. Maximum vertical descent 1.83 m (6 ft/s); with lateral drift 0.91 m (3 ft/s) for deck landing. Flotation gear, and deck securing system, optional. Latter include RDM Deadlock, Trigon 3, Trigon 5, Assist and PRISM, to customer's requirements.

POWER PLANT: Current option of two Rolls-Royce Gem 42-1 turboshafts, each rated at 746 kW (1,000 shp) for T-O or 664 kW (890 shp) max continuous; or two LHTEC CTS800-4Ns, each of 1,016 kW (1,362 shp) and 945 kW (1,267 shp), respectively. Additionally, CTS800 can supply 1,123 kW (1,506 shp) for 2 minutes max contingency or 1,208 kW (1,620 shp) for 30 seconds emergency rating. Transmission rating 1,372 kW (1,840 shp). Exhaust diffusers for IR suppression optional on Battlefield Lynx.

Fuel in five internal tanks; usable capacity 957 litres (253 US gallons; 210 Imp gallons) when gravity-refuelled; 985 litres (260 US gallons; 217 Imp gallons) when pressure-refuelled. Optional internal tank, replacing bench seat at rear of cabin, capacity 345 litres (91.0 US gallons; 75.9 Imp gallons). For ferrying, two tanks each of 441 litres (116 US gallons; 97.0 Imp gallons) in cabin, replacing bench tank. Maximum usable fuel 1,867 litres (493 US gallons; 411 Imp gallons). Engine oil tank capacity 6.8 litres (1.8 US gallons; 1.5 Imp gallons). Main rotor gearbox oil capacity 28 litres (7.4 US gallons; 6.2 Imp gallons).

ACCOMMODATION: Pilot and co-pilot or observer on side-by-side seats. Dual controls optional. Individual forward-hinged cockpit door and large rearward-sliding cabin door on each side; cockpit doors jettisonable; windows of cabin doors also jettisonable. Cockpit accessible from cabin area. Maximum high-density layout (military version) for one pilot and 10 armed troops or paratroops, on lightweight bench seats in soundproofed cabin. Alternative VIP layouts for four to seven passengers, with additional cabin soundproofing. Seats can be removed quickly to permit carriage of up to 907 kg (2,000 lb) of freight internally. Tiedown rings provided. In casualty evacuation role, with a crew of two, Lynx can accommodate up to six Alpin stretchers and a medical attendant. Both basic versions have secondary capability for search and rescue (up to nine survivors) and other roles.

SYSTEMS: Two independent hydraulic systems, pressure 141 bar (2,050 lb/sq in). Third hydraulic system provided in naval version when sonar equipment installed. No pneumatic system. 28 V DC electrical power supplied by two 6.3 kW engine-driven starter/generators and an alternator. External power sockets, 24 V 23 Ah (optionally 40 Ah) Ni/Cd battery fitted for essential services and emergency engine starting. 200 V three-phase AC power available at 400 Hz from two 25 kVA transmission-driven alternators. Cabin heating and ventilation system. Optional supplementary cockpit air conditioning system. Electric anti-icing and demisting of windscreen, and electrically operated windscreen wipers, standard; windscreen washing system.

AVIONICS: *Comms:* Typically Rockwell Collins VOR/ILS; DME; Rockwell Collins AN/ARN-118 Tacan; I-band transponder (naval version only); BAE PTR446, Rockwell Collins APX-72, DaimlerChrysler STR 700/375 or Italtel APX-77 IFF.

Flight: BAE duplex three-axis automatic stabilisation equipment; BAE GM9 Gyrosyn compass system; Racal tactical air navigation system (TANS); Racal 71 Doppler, E2C standby compass. BAE Mk 34 AFCS. Additional units fitted in naval version, when sonar is installed, to provide automatic transition to hover and automatic Doppler hold in hover. Latest versions have Racal Doppler 91 and RNS 252 navigation; Honeywell/Smiths AN/APN-198 radar altimeter; Rockwell Collins 206A ADF; Rockwell Collins VIR 31A VOR/ILS.

Radar: Optional Seaspray Mk 3000 or Honeywell RDR 1500 360° scan radar in chin fairing. BAE Sea Owl thermal imaging equipment optional above nose.

Mission: Optional Honeywell AN/AQS-18 or Thomson HS-312 sonars in naval variants. Detection of submarines by dipping sonar or magnetic anomaly detector. Dipping sonar operated by hydraulically powered winch and cable hoist mode facilities within the AFCS.

LYNX PRODUCTION					
Variant	Customer	Qty	First aircraft	First flights	Operators
AH. Mk 1	Army Air Corps	113 ¹³	XZ170	11 Feb 1977-24 Jan 1984	Converted to Mk 3 31F, 34F, ERCE 815, 702 Sqdns 31F, 34F, ERCE DERA
HAS. Mk 2	Fleet Air Arm	60	XZ227	20 Feb 1976-26 May 1981	
HAS. Mk 2(FN)	French Navy	26	260	4 May 1977-5 Sep 1979	
HAS. Mk 3	Fleet Air Arm	31	ZD249	4 Jan 1982-21 Oct 1988	
HAS. Mk 4(FN)	French Navy	14	801	1 Apr 1982-26 Aug 1983	31F, 34F, ERCE DERA
Mk 5	MoD(PE)	3 ¹³	ZD285	21 Nov 1984-23 Feb 1985	
AH. Mk 6	Royal Marines	-	-	None built	
AH. Mk 7	Army Air Corps	11 ¹³	ZE376	23 Apr 1985-5 Jun 1987	
HMA. Mk 8	Fleet Air Arm	-	-	Conversions	815, 702 Sqdns
AH. Mk 9	Army Air Corps	16 ^{13,14}	ZG884	20 Jul 1990-21 Jun 1992	653, 659 Sqdns
Mk 21	Brazilian Navy	9	N3020	30 Sep 1977-14 Apr 1978	Five upgraded to 21A
Mk 21A	Brazilian Navy	9 ¹⁴	N4001	12 Jun 1996-24 Apr 1997	1° EHEAA
Mk 22	Egyptian Navy	-	-	None built	-
Mk 23	Argentine Navy	2	0734	17 May 1978-23 Jun 1978	Withdrawn from service
Mk 24	Iraqi Army	-	-	None built	-
Mk 25 ¹	Netherlands Navy	6	260	23 Aug 1976-16 Sep 1977	7/860 Sqdns
Mk 26	Iraqi Army (armed)	-	-	None built	-
Mk 27 ²	Netherlands Navy	10	266	6 Oct 1978-12 Nov 1979	7/860 Sqdns
Mk 28	Qatari Police	3 ¹³	QP-31	2 Dec 1977-12 Apr 1978	Withdrawn from service ⁷
Mk 64	South African Navy ¹⁰	4 ¹⁴	-	-	22 Squadron
Mk 80 ¹²	Danish Navy	8 ¹¹	S-134	3 Feb 1980-15 Sep 1981	See Mk 90
Mk 81 ³	Netherlands Navy	8	276	9 Jul 1980-24 Mar 1981	7/860 Sqdns
Mk 82	Egyptian Army	-	-	None built	-
Mk 83	Saudi Army	-	-	None built	-
Mk 84	Qatari Army	-	-	None built	-
Mk 85	UAE Army	-	-	None built	-
Mk 86	Norwegian Coast Guard	6	207	23 Jan 1981-11 Sep 1981	Skv 337
Mk 87	Argentine Navy	-	-	Embargoed	-
Mk 88	German Navy	19 ⁹	8301	26 May 1981-10 Dec 1988	3/MFG 3
Mk 88A	German Navy	7 ¹⁴	8320	30 Apr 1999 — Mar 2000	3/MFG 3
Mk 89	Nigerian Navy	3	01-F89	29 Sep 1983-14 Mar 1984	101 Sqdn
Mk 90 ¹²	Danish Navy	1 ⁴	S-256	19 Apr 1988 ⁶	Søværnets Flyvetjeneste
Mk 95	Portuguese Navy	3 ^{14,5}	9203	9 Jul 1993-1993	EHM ⁸
Mk 99	South Korean Navy	12 ¹⁴	90-0701	16 Nov 1989-14 May 1991	627 Sqdn
Mk 99A	South Korean Navy	13 ¹⁴	99-0721	3 Jul 1999-Aug 2000	629 Sqdn
Srs 300/Mk 100	Malaysian Navy	6 ¹⁴	M501-1	28 Mar 2002	501 Sqdn
Srs 300	Thai Navy	2 ¹⁴	2313	26 Jul 04	203 Sqdn
Srs 300/Mk 120	Oman Air Force	16 ¹⁴	757	25 Oct 2003	3 Sqdn
Subtotal		417			
Lynx 3		1	ZE477	14 Jun 1984	
Demonstrators		3	G-LYNX	18 May 1979-27 Jan 1999	
Prototypes		13	XW835	21 Mar 1971-5 Mar 1975	
Total		434			

Notes: Note A: Army Air Corps 651, 652, 654, 655, 656, 657, 659, 661, 662, 663, 664, 665, 667, 669 and 671 Squadrons; 847 Squadron (Royal Marine Commando)

¹ Netherlands designation UH-14A; all to SH-14D
² Netherlands designation SH-14B; all to SH-14D
³ Netherlands designation SH-14C; all to SH-14D
⁴ Plus one conversion from demonstrator; these two upgraded to Super Lynx Mk 90B with new airframes
⁵ Plus two conversions from Mk 3
⁶ Completion and first flight at Værløse, Denmark
⁷ Sold to Royal Navy for spares recovery and use as ground instructional airframes
⁸ Esquadilha de Helicópteros de Marinha
⁹ Surviving 15 upgraded to Super Lynx with new airframes in 2001-2003
¹⁰ Programme delay announced in 1999; go-ahead given February 2003
¹¹ Surviving six converted to Super Lynx Mk 90B with new airframes
¹² Converted during 1990s to Mk 80A/90A with Gem 42-1 engines
¹³ Army version
¹⁴ Super/Battlefield Lynx

EQUIPMENT: All versions equipped as standard with navigation, cabin and cockpit lights; adjustable landing light under nose; and anti-collision beacon. For search and rescue, with three crew, both versions can have a waterproof floor and a 272 kg (600 lb) capacity clip-on hydraulic or electric hoist on starboard side of cabin; cable length 30 m (98 ft).

ARMAMENT: For armed escort, anti-tank or air-to-surface strike missions, army version can be equipped with two 20 mm cannon mounted externally so as to permit fitment of pintle-mounted 7.62 mm machine gun inside cabin. External pylon can be fitted on each side of cabin for variety of stores, including two Minigun or other self-contained gun pods; two rocket pods; or up to eight HOT, Hellfire, TOW, or similar air-to-surface missiles. Additional six or eight reload missiles carried in cabin. For ASW role, armament includes two Mk 44, Mk 46, A244S or Sting Ray homing torpedoes, one each on an external pylon on each side of fuselage, and six marine markers; or two Mk 11 depth charges. Alternatively, up to four Sea Skua semi-active homing missiles; on French Navy Lynx, four AS.12 or similar wire-guided missiles.

Following data refer to Super Lynx.

DIMENSIONS, EXTERNAL:

Main rotor diameter 12.80 m (42 ft 0 in)
Tail rotor diameter 2.36 m (7 ft 9 in)
Distance between rotor centres 7.66 m (25 ft 1½ in)
Length of fuselage, tail rotor turning 13.34 m (43 ft 9¼ in)
Length overall:
 both rotors turning 15.24 m (50 ft 0 in)
 main rotor blades and tail folded 10.85 m (35 ft 7¼ in)
Width overall, main rotor blades folded 2.94 m (9 ft 7¾ in)
Height overall: tail rotor turning 3.67 m (12 ft 0½ in)
 main rotor blades and tail folded 3.25 m (10 ft 8 in)
Tailplane half-span 1.32 m (4 ft 4 in)
Wheel track 2.94 m (9 ft 7¾ in)
Wheelbase 3.02 m (9 ft 11 in)

DIMENSIONS, INTERNAL:

Cabin, from back of pilots' seats:
 Min length 2.055 m (6 ft 9 in)
 Max width 1.78 m (5 ft 10 in)
 Max height 1.42 m (4 ft 8 in)
 Floor area 3.45 m² (37.1 sq ft)
 Volume 4.9 m³ (173 cu ft)

Cabin doorway: Width 1.37 m (4 ft 6 in)
Height 1.19 m (3 ft 11 in)

AREAS:
Main rotor disc 128.71 m² (1,385.4 sq ft)
Tail rotor disc 4.37 m² (47.04 sq ft)

WEIGHTS AND LOADINGS:
Manufacturer's basic weight 3,291 kg (7,255 lb)
Operating weight empty (including crew and appropriate armament):
 ASW (two torpedoes) 4,618 kg (10,181 lb)
 ASV (four Sea Skuas) 4,373 kg (9,641 lb)
 surveillance and targeting 3,708 kg (8,174 lb)
 search and rescue 3,778 kg (8,329 lb)
Max underslung load 1,361 kg (3,000 lb)
Max fuel weight: normal 787 kg (1,735 lb)
 bench seat 275 kg (606 lb)
 ferry tanks, total two 696 kg (1,534 lb)
Max T-O weight 5,330 kg (11,750 lb)
Max disc loading 41.4 kg/m² (8.48 lb/sq ft)
Transmission loading at max T-O weight and power 3.89 kg/kW (6.39 lb/shp)

PERFORMANCE (CTS800 engines):
Max continuous cruising speed 132 kt (244 km/h; 152 mph)
Hovering ceiling IGE, ISA +20°C 2,105 m (6,900 ft)
Hovering ceiling OGE, ISA +20°C 1,445 m (4,740 ft)
Radius of action:
 range with auxiliary fuel 540 n miles (1,000 km; 621 miles)
 anti-submarine, 2 h on station, dipping sonar and one torpedo 20 n miles (37 km; 23 miles)
 point attack with four Sea Skuas 125 n miles (232 km; 143 miles)
 surveillance, 3 h 50 min on station 75 n miles (139 km; 86 miles)
Max endurance with auxiliary fuel 5 h 20 min

AGUSTAWESTLAND A 109
US Coast Guard designation: MH-68A Stingray
Swedish armed forces designation: Hkp 15
TYPE: Light utility helicopter.



Royal Air Force AgustaWestland A 109E Power used for VIP transport

1158287

PROGRAMME: First flight of original A 109 4 August 1971; deliveries of A 109A started early 1976; single-pilot IFR certification 20 January 1977; deliveries of uprated A 109 Mk II began September 1981; A 109C certified 1989; first deliveries February 1989; A 109 Max was medevac version; A 109CM and A 109EOA for military use.

First flight of A 109K April 1983; first flight of production representative second aircraft March 1984. A 109K2s of REGA air ambulance fitted with Sextant AFDS 95-1 AFCS, granted FAA single-pilot IFR certification late in 1996.

A 109 Power programme begun in 1993, intending to unify A 109C and A 109K2; initially known as A 109 Unified; launched November 1993; unique A 109D development aircraft with FADEC-equipped Allison 250-C22R9s flew 1 October 1994; prototype A 109E (I-EPWS) flew 8 February 1995. A 109D became second A 109E prototype.

CURRENT VERSIONS: **A 109KM:** Military version of A 109K2; roles include anti-tank/scout, escort, command and control, utility, ECM and SAR/medevac; fixed landing gear; sliding side doors.

A 109KN: Shipboard version with equivalent roles to A 109KM, including anti-ship, over-the-horizon surveillance and targeting and vertical replenishment.

A 109K2: Special civil rescue version first sold to Swiss REGA non-profit rescue service; REGA equipment includes Spectrolab SX-16 searchlight, 1,000 kg (2,204 lb) cargo hook, GPS, Elbit moving map display and single-pilot IFR instrumentation; NVG compatible. Equipped with Thales AFDS 95-1 AFCS from 1996.

A 109K2 Law Enforcement: Dedicated police version; optional equipment includes 907 kg (2,000 lb) cargo hook, 204 kg (450 lb) capacity variable speed rescue hoist with 50 m (164 ft) of cable, rappelling kit, wire-strike protection, SX-16 searchlight, MA3 retractable light, external loudspeakers, emergency floats, GPS, FM tactical communications, weather radar, LLTV and FLIR.

A 109 Power: Revealed at 1995 Paris Air Show, by which time prototype had accumulated more than 60 hours of flight testing. Engineering designation is **A 109E**. Based on A 109K2 airframe with new, A 129-derived lightweight, low-maintenance titanium main rotor head connected to composites material grips via single elastomeric bearing on each blade; Pratt & Whitney Canada PW206C or Turbomeca Arrius 2K1 engines; new heavy-duty high-clearance landing gear in revised position below fuselage; cabin as for A 109K2, retaining quick-change facility from passenger to EMS operation. First production aircraft (I-PWER) completed late 1995; RAI IFR certification 31 May 1996; FAA IFR certification 26 August 1996. Aircraft with Rogerson HDS (integrated instrument display system) cockpit (I-EAPW; first production) displayed at 1997 Paris Air Show. First 120 or so Powers had P&W engines; Turbomeca variant phased in with delivery of N7YL to Erie Lifestar in early September 2001. PZL-Świdnik of Poland contracted to build fuselages for A 109E between 1996 and 2002 as alternative production source.

US Coast Guard MH-68A (see Customers, below) is equipped with night vision device (NVD) cockpit, FLIR, weather radar and machine gun. Following trials aboard the USCGC Gallatin (WHEC 721) in early 2001, the MH-68A has been cleared for deployment aboard all helicopter-capable cutters in the USCG fleet. MH-68A fleet had logged 10,667 hours by 28 April 2004.

A 109 Power Elite: Special edition of A 109E; improved interior and soundproofing; limited to 50 aircraft, c/n's 11151 to 11200, of which first (I-RAIB) exhibited at Paris in June 2001; initial export, fourth Elite, was delivered to Air Harrods in UK, May 2002; some 26 built by end of 2004, including first for Italian Carabinieri; none further by 2006.



Swedish armed forces AgustaWestland Hkp 15A

1037994

MH-68A: US Coast Guard version of A 109E (P & W version). Provision for MG240 machine gun in port doorway and rescue hoist over starboard door. Night vision compatible cockpit; encrypted radios.

A 109LUH: Formerly A109M. Military version of A 109E with PW207C or Arrius 2K2 engine. Swedish armed forces ordered 20, under designation Hkp 15, on 20 June 2001; two leased helicopters handed over 10 September 2002. First production Hkp 15 handed over to Swedish Defence Material Agency (FMV) 2 February 2006 prior to service entry on 28 March; used for crew training, utility, ASW, SAR and Medevac missions; versions are **Hkp 15A** (12) for land operations; and **Hkp 15B** (eight) equipped to operate from 'Visby' class corvettes.

Requirement for 40 A 109LUHs announced by South African Air Force in November 1998 of which 30 ordered, with 10 options; these likely to be equipped with IST Dynamics turret mounting a Vektor multiple-calibre gun; first five manufactured in Italy, remainder by the Denel Group in South Africa. Initial Agusta-built aircraft rolled out 6 September 2002; Turbomeca engines. First Denel-built aircraft (4006) entered final assembly in February 2003 and made its public debut at the Africa Aerospace and Defence 2004 exhibition on 22 September 2004.

A 109LOH: Light observation helicopter variant. Selected by Malaysian Army Aviation in September 2003, with order for 11, plus initial support and training package, valued at USD70 million. First delivery (M81-01) December 2005.

A 109S Grand: Described separately.

CUSTOMERS: Some 817 of A 109 family built by January 2006 as detailed in adjacent table.

AGUSTAWESTLAND A 109 PRODUCTION (at January 2006)		
Variant	Qty	Remarks
A 109	4	Prototypes and pre-series
A 109A/II/EOA	343	
A 109	(2)	Static test airframes Belgian Army
A 109BA	46	
A 109C Max	82	Prototype
A 109D	1	
A 109E	256	Peruvian Army
A 109E Elite	26	
A 109K	12	South Africa, Total 30
A 109K2	39	
A 109LUH	7	Sweden, Total 20
A 109LUH/Hkp 15	-	
A 109LOH	1	Malaysia, Total 11
Total	817	

Customers include the US Coast Guard, which ordered four A 109Es (with four options, all taken up and delivered by late 2001, and two further options announced in February 2003) in interdiction configuration in April 2000 to equip Helicopter Interdiction Tactical Squadron 10 (HITRON TEN) based at Jacksonville, Florida, for armed anti-drug missions; Italy's Carabinieri, which took delivery of two A 109Es in 2000; Duke Life Flight of Durham, North Carolina, which took delivery of two A 109Es in EMS configuration in December 2001 and January 2002; the Italian government, which ordered one A 109E in



First A 109LOH for Malaysian Army Aviation, handed over on 8 December 2005

1037989

VIP configuration for the Prime Minister's use; car manufacturer and Formula One racing team Ferrari, one A 109E: Air Harrods of the UK, one A 109E: Careflite, of Dallas-Fort Worth, Texas, which ordered four A 109Es in EMS configuration, the last of which was delivered on 30 December 2002, plus one ordered in February 2003, plus three options; Shenzhen Police of China, which ordered one A109E, plus two options, in January 2003; and the Slovenian Ministry of Defence, which ordered one, plus two options, in January 2003 for border patrol, civil protection, SAR and EMS duties. Greek government ordered five A 109Es in EMS configuration in 1999, and Dyfed/Powys Police Authority in the UK took delivery of an A 109E in late 1999, and ordered a replacement in March 2003.

Nigerian Navy ordered four Turbomeca-engined A 109 Powers for anti-smuggling duties in the Niger delta, first two delivered mid-2002, followed by remaining two in September 2004. Deer Jet of China ordered two A 109E Powers for harbour pilot shuttle services. Japanese National Police Agency ordered three A 109Es in June 2003, for delivery by end of year, for operation in Hiroshima, Fukushima and Niigata. UK operator Euro SkyLink took delivery of an A 109E Power in May 2004. Phoenix Police Department Air Patrol Unit and the Government of Rajasthan each ordered one A109 Power in July 2004; Airlift Northwest of Seattle ordered two A 109 Powers in October 2004; LifeFlight of Maine took delivery of two A 109 Powers in EMS configuration in December 2004.

More recent customers included Aerolineas Ejecutivas SA of Mexico, which ordered two A 109 Powers in February 2005; Saudi Aranco, which has ordered seven A 109 Powers, of which the first two were delivered in November 2005; and Libyan Italian Advanced Technology Company (LIATEC), which has ordered 10 A 109 Powers by delivery commencing in late 2006/early 2007 to be used for border patrol; the Royal Air Force, which took delivery of the first of three A 109 Powers on 22 March for operation by No. 32 (The Royal) Squadron at RAF Northolt on a five-year contract that commenced on 1 April 2006; Latvia's Ministry of the Interior, which has ordered two A 109 Powers for border and law enforcement; Medair of Turkey, Power which took delivery of an A 109 in June 2006; the Japanese National Police Agency, which ordered four A 109 Powers in June 2006; and the Beijing Municipality Public Security Bureau, which ordered three A 109 Powers in June 2006.

COSTS: A 109E USD3.2 million to USD3.5 million (2002). A 109K2 USD3.5 million (2001). A 109E direct operating cost USD380 per hour (2000). US Coast Guard contract for four A 109Es valued at USD18.6 million (2000). Swedish armed forces order for 20 A 109Ms valued at €130 million (2001).

DESIGN FEATURES: Fully articulated four-blade metal main rotor hub with tension/torsion blade attachment and elastomeric bearings; delta-hinged two-blade stainless steel tail rotor; manual blade folding and rotor brake optional. Main blade section NACA 23011 with drooped leading-edge; thickness/chord ratios 11.3 per cent at root, 6 per cent at tip. Tail rotor with Wortmann aerofoil and stainless steel skins; optional rotor brake. Compared with earlier models, A 109K has lengthened cabin to hold two stretchers fore and aft; modified fuel system; and smaller instrument panel.

FLYING CONTROLS: Fully powered hydraulic; IFR system with autopilot available. A 109KM has three-axis stability augmentation/attitude hold system; dual redundant IFR system and four-axis AFCS with flight path computer optional.

LANDING GEAR: A 109K series has non-retractable tricycle type, giving increased clearance between fuselage and ground. A 109E Power has tricycle type, with oleo-pneumatic shock-absorber in each unit. Single mainwheels and self-centring nosewheel casting $\pm 45^\circ$. Hydraulic retraction, nosewheel forward, mainwheels upward into fuselage. Hydraulic emergency extension and locking. Magnaghi disc brakes on mainwheels. All tyres are tubeless, of same size (360x135-6 or 380x135-6 or 14.5x5.5-6, 12/14 ply tubeless) and pressure (5.90 bar; 85 lb/sq in). Tailskid under ventral fin. Emergency pop-out flotation gear and fixed snow skis optional on all models.

POWER PLANT: A 109K: Two Turbomeca Arriel 1K1 turboshafts, each rated at 575 kW (771 shp) for 2½ minutes, 550 kW (737 shp) for take-off (30 minutes) and 471 kW (632 shp) maximum continuous power. Engine particle separator optional. Main transmission uprated to 671 kW (900 shp) for take-off and maximum continuous twin-engine operation; single-engine rating is 477 kW (640 shp) for 2½ minutes and 418 kW (560 shp) maximum continuous. Main rotor rpm 384, tail rotor 2,085. Standard usable fuel capacity 750 litres (198 US gallons; 165 Imp gallons), with optional 150 litre (39.6 US gallon; 33.0 Imp gallon) auxiliary tank for EMS operations, or 200 litre (52.8 US gallon; 44.0 Imp gallon) auxiliary tank in the A 109KM. Self-sealing fuel tanks optional. Independent fuel and oil system for each engine.

A 109E: Two Pratt & Whitney Canada PW206C engines, each rated at 477 kW (640 shp) for T-O, 423 kW (567 shp) for twin-engine operation, 546 kW (732 shp) for 2½ minutes' OEI contingency rating and 500 kW (670 shp) maximum continuous OEI; or two Turbomeca Arrius 2K1, each rated at 500 kW (670 shp) for T-O, 425 kW (570 shp) for twin-engine operation, 559 kW (750 shp) for 2½ minutes' OEI contingencies and 500 kW (670 shp) maximum continuous OEI; transmission rating 671 kW (900 shp) for T-O and maximum continuous for twin-engine operation, 418 kW (560 shp) maximum continuous and 477 kW (640 shp) for 2½ minutes' OEI; FADEC and liquid crystal multifunction displays for engine management. Standard fuel capacity (three cells) 605 litres (160 US gallons; 133 Imp gallons); optional capacity 710 litres (187 US gallons; 156 Imp gallons) with one extra cell or 870 litres (230 US gallons; 191 Imp gallons) with two extra cells.

SYSTEMS: Military versions have electrical system supplied by two 160 A 28 V DC self-cooled starter/generators and 27 Ah 28 V Ni/Cd battery. Optional AC electrical system comprises two 250 VA or two high-load 600 VA 115/26 V AC 400 Hz static inverters. Optional high-load AC system comprises one 6 kVA alternator and one standby 250 VA solid-state

inverter. Dual independent hydraulic systems for flight controls, each capable of operating main actuators in the event of failure of the other system; utility hydraulic system with normal and emergency accumulators for operation of rotor brake, wheel brakes and nosewheel centring.

AVIONICS: A109E has Rockwell Collins Pro Line II or Bendix/King Silver Crown as core system. Military versions have ergonomic, NVG-compatible flight deck with provision for IFR instrumentation and role/mission dedicated displays.

Comms: VHF/AM, VHF/FM, UHF, HF, three-station intercom, IFF and ELT.

Radar: Colour weather radar optional.

Flight: ADF, VOR/GS/ILS, DME, GPS and VLF-Omega. Optional Rockwell Collins CMS80 cockpit management system with one or more centrally mounted CDUs and automatic target hand-off system compatibility.

Mission: FLIR.

Self-defence: Radar/laser warning receivers and chaff/flare/smoke dispensers.

EQUIPMENT: Optional equipment for military use includes windscreen wipers, rear view mirror, bleed air heater, particle separator, engine fire extinguisher, oxygen system, environmental control unit, one- or two-stretcher installation, air ambulance kit, external loudspeaker system, high-intensity searchlight, cargo platform, external cargo hook with maximum capacity 1,000 kg (2,205 lb), rescue hoist maximum capacity 270 kg (595 lb), snow skis and emergency floats.

ARMAMENT (optional): Internal armament comprises pintle-mounted 7.62 mm machine gun and 12.7 mm machine gun in doorway. Provision for carriage of four or eight TOW, TOW 1, TOW 2 or TOW 2A missiles on external lateral pylons, each of 300 kg (661 lb) maximum capacity, with roof-mounted HeliTOW sight or APX M 334 or Helios gyro-stabilised sights. Alternatively, pylons can accommodate seven- or 12-tube pods for 2.75 in or 81 mm rockets; rocket/machine gun (RPM) pods each with three 70 mm rockets and a 12.7 mm machine gun with 200 rounds; or machine gun (MG) pods with 12.7 mm gun (and 250 rounds) or 7.62 mm gun. A 109M has 12.7 mm or 20 mm nose-mounted turret gun.

DIMENSIONS, EXTERNAL:

Main rotor diameter	11.00 m (36 ft 1 in)
Tail rotor diameter	2.00 m (6 ft 6½ in)
Length overall, rotors turning	13.04 m (42 ft 9 in)
Fuselage length	11.44 m (37 ft 6 in)
Height over tailfin	3.50 m (11 ft 5¼ in)
Tailplane span	2.88 m (9 ft 5½ in)
Width overall, rotor in 'X'	7.78 m (25 ft 6¼ in)
Width over mainwheels	2.45 m (8 ft 0½ in)
Wheelbase	3.535 m (11 ft 7¼ in)
Main rotor tip ground clearance	2.45 m (8 ft 0½ in)
Fuselage ground clearance	0.40 m (1 ft 3¾ in)
Passenger doors (each): Height	1.06 m (3 ft 5¼ in)
Width	1.15 m (3 ft 9¼ in)
Height to sill	0.65 m (2 ft 1½ in)
Baggage door (port, rear): Height	0.51 m (1 ft 8 in)
Width	1.00 m (3 ft 3¼ in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.10 m (6 ft 10¾ in)
Max width: KM, K2	1.59 m (5 ft 2½ in)
E	1.61 m (5 ft 3½ in)
Max height	1.28 m (4 ft 2½ in)
Volume, incl flight deck: K2	4.9 m³ (173 cu ft)
E	5.1 m³ (180 cu ft)
Baggage compartment volume: K2	0.85 m³ (30.0 cu ft)
E	0.95 m³ (33.6 cu ft)

AREAS:

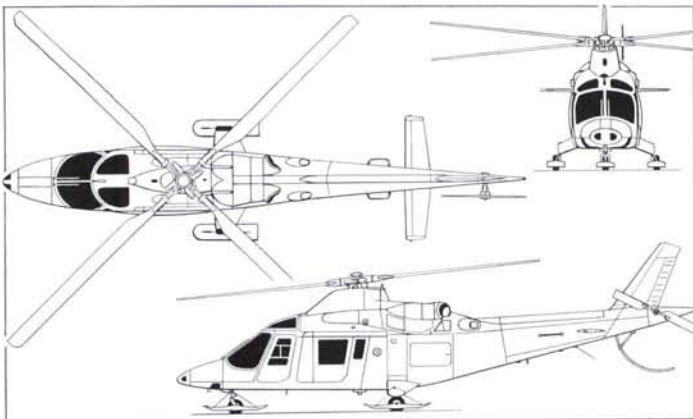
Main rotor disc	95.03 m² (1,022.9 sq ft)
Tail rotor disc	3.14 m² (33.82 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: KM	1,660 kg (3,660 lb)
K2	1,650 kg (3,638 lb)
E	1,585 kg (3,494 lb)
LUH	1,639 kg (3,614 lb)
Max slung load	1,000 kg (2,204 lb)
Max T-O weight: all	2,850 kg (6,283 lb)
Max T-O weight with slung load: all	3,000 kg (6,613 lb)
Max disc loading:	
KM, K2, E	30.0 kg/m² (6.14 lb/sq ft)
Transmission loading at max T-O weight and power:	
all	4.24 kg/kW (6.97 lb/shp)

PERFORMANCE:

Never-exceed speed (VNE):	
KM, K2	152 kt (281 km/h; 174 mph)
E, LUH	168 kt (311 km/h; 193 mph)
Max cruising speed at S/L, clean:	
KM, K2	143 kt (264 km/h; 164 mph)
E	154 kt (285 km/h; 177 mph)
LUH	151 kt (280 km/h; 174 mph)
Max rate of climb at S/L: KM, K2	594 m (1,950 ft)/min
E, LUH	588 m (1,930 ft)/min
Rate of climb at S/L, OEI:	
KM, K2, LUH	274 m (900 ft)/min
Service ceiling: KM, K2	6,100 m (20,000 ft)
E	5,974 m (19,600 ft)
LUH	5,029 m (16,500 ft)
Service ceiling, OEI: KM, K2	3,660 m (12,000 ft)
E, LUH	3,990 m (13,100 ft)
Hovering ceiling IGE: KM, K2	5,305 m (17,400 ft)
E	5,060 m (16,600 ft)
LUH	4,328 m (14,200 ft)
Hovering ceiling OGE: KM, K2	3,900 m (12,800 ft)
E	3,597 m (11,800 ft)
LUH	2,957 m (9,700 ft)
Max range, best height and speed, max optional (five cells) fuel:	
KM, K2	434 n miles (805 km; 500 miles)
E	521 n miles (964 km; 599 miles)
LUH	447 n miles (827 km; 514 miles)
Endurance: KM, K2	4 h 0 min
E	5 h 5 min
LUH	4 h 29 min



AgustaWestland A 109K2 civil rescue and utility helicopter (two Turbomeca Arriel 1K1 turboshafts) (Dennis Punnett)

0507372

AGUSTAWESTLAND A 109S GRAND

TYPE: Light utility helicopter.
PROGRAMME: Version of A 109 with enlarged cabin, unveiled in mockup form at Farnborough International, 20 July 2004. However, first of two prototypes (c/n 22001 and 22002) flown in 2002 and 2003, respectively (unannounced) and by July 2004 had accumulated combined 200 hours. First production Grand (I-RAID, c/n 22003) made public debut at Paris Air Show, where EASA certification formally presented on 15 June 2005.
CUSTOMERS: Approximately 10 sold by time of unveiling, mid-2004. Deliveries planned from 2005 onwards, with 15 to be supplied to customers by end of 2006. Announced customers include US launch customer Seacor Holdings Inc, parent company of offshore operator Tex-Air Helicopters, which ordered three in September 2004; Aerolineas Ejecutivas of Mexico, which ordered two in February 2005; Airlift Northwest (USA), four; Heli Dubai, two; and Baxter Air (South Africa), one. First production Grand was re-registered G-CGRI in August 2005 and delivered to C G Roach in UK; second also for UK operator, Errigal Helicopters, in October 2005. Total two delivered by end of 2005.
COSTS: USD4.0 million to USD4.7 million (2004). Variable operating cost USD677 per hour (2005).

Data generally as for A 109, except that following.
DESIGN FEATURES: A 109 fuselage stretched by 0.21 m (8¼ in), allowing second window in cabin door. Quieter, scimitar-shape tail rotor. Certified to FAR/JAR 27, but with capabilities approaching FAR/JAR 29 standards

POWER PLANT: Two Pratt & Whitney Canada PW207C turboshafts with FADEC, each rated at 548 kW (735 shp) for T-O; 466 kW (625 shp) max continuous; 608 kW (815 shp) OEI max contingency for 2 min 30 s; and 548 kW (735 shp) OEI max continuous. Transmission rating 716 kW (960 shp) for T-O; 671 kW (900 shp) max continuous; 545 kW (730 shp) OEI max contingency; and 448 kW (600 shp) OEI max continuous. Fuel capacity (all minus 10 litres; 2.6 US gallons; 2.2 Imp gallons unusable): 576 litres (152 US gallons; 127 Imp gallons) with three-cell system; 674 litres (178 US gallons; 148 Imp gallons) with four-cell system; or 818 litres (216 US gallons; 180 Imp gallons) with five-cell system.

ACCOMMODATION: Eight persons, including one or two crew. Corporate/VIP configuration with five or six seats in club configuration. Baggage compartment, with external door, in tailboom.

AVIONICS: *Instrumentation:* Four flight/navigation LCDs, plus two data monitoring LCDs.

DIMENSIONS, EXTERNAL:

Main rotor diameter	10.83 m (35 ft 6½ in)
Tail rotor diameter	1.94 m (6 ft 4½ in)
Length overall: rotors turning	12.96 m (42 ft 6¼ in)
Fuselage: Length	11.65 m (38 ft 2½ in)
Max width	1.64 m (5 ft 4½ in)
Height over tailfin	3.44 m (11 ft 3½ in)
Tailplane span	2.88 m (9 ft 5½ in)
Wheel track	2.15 m (7 ft 0½ in)
Wheelbase	3.74 m (12 ft 3¼ in)
Ground clearance: fuselage	0.40 m (1 ft 3¼ in)
tail rotor	1.00 m (3 ft 3¼ in)
Passenger doors (each): Width	1.40 m (4 ft 7 in)

DIMENSIONS, INTERNAL:

Cockpit volume	1.7 m³ (58 cu ft)
Cabin (excl cockpit):	
Length: at floor	2.30 m (7 ft 6½ in)
at roof	1.90 m (6 ft 2¾ in)
Max height	1.28 m (4 ft 2½ in)
Volume	3.9 m³ (138 sq ft)
Baggage compartment: Length	2.30 m (7 ft 6½ in)
Max height	0.71 m (2 ft 4 in)
Volume	0.95 m³ (33.5 cu ft)

AREAS:

Main rotor disc	92.12 m² (991.6 sq ft)
Tail rotor disc	2.96 m² (31.82 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	1,655 kg (3,649 lb)
Max fuel weight: three cells	460 kg (1,014 lb)
four cells	535 kg (1,179 lb)
five cells	644 kg (1,420 lb)



First production AgustaWestland A 109S Grand after delivery to Mr C G Roach in UK (Paul Jackson)

1037931



AgustaWestland A 109 Grand eight-seat utility helicopter (Paul Jackson)

0589208

Max T-O weight: internal load	3,175 kg (7,000 lb)
underslung load	3,200 kg (7,054 lb)
Max disc loading: internal load	34.5 kg/m² (7.06 lb/sq ft)
underslung load	34.7 kg/m² (7.11 lb/sq ft)
Transmission loading at max T-O weight and power:	
internal load	4.44 kg/kW (7.29 lb/shp)
external load	4.77 kg/kW (7.84 lb/shp)

PERFORMANCE:

Never-exceed speed (VNE)	168 kt (311 km/h; 193 mph)
Max cruising speed at S/L	155 kt (287 km/h; 178 mph)
Max rate of climb at S/L	558 m (1,830 ft)/min
Max rate of climb at S/L, OEI	326 m (1,070 ft)/min
Hovering ceiling: IGE	4,572 m (15,000 ft)
OGE	3,048 m (10,000 ft)
Service ceiling	4,938 m (16,200 ft)
Service ceiling, OEI	2,896 m (9,500 ft)
Range with five fuel cells at FL50	480 n miles (889 km; 552 miles)
Endurance with five fuel cells at FL50	4 h 28 min

OPERATIONAL NOISE LEVELS:

T-O	90.5 EPNdB
Approach	91.2 EPNdB
Overflight	88.4 EPNdB

AGUSTAWESTLAND A 119 KOALA

TYPE: Light utility helicopter.
PROGRAMME: First flight (I-KNEW, second airframe) early 1995; public debut by static test first airframe (I-KOAL) at Paris Air Show June 1995; both initially with 597 kW (800 shp) Turbomeca Arriel 1 turboshaft; rebuilt with PT6B turboshafts early in 1997 as I-KOAL c/n 14003 and I-KNEW c/n 14004; demonstrator and first production aircraft (I-KNOW) added in 1999 and US demonstrator in 2000; FAA certification 28 April 2000; initial delivery (VH-FOX) to Linfox Holdings, Melbourne, Australia, 25 September 2000.

As part of South African purchase of 40 military A 109s, Denel (which see) is assembling and marketing the Koala in Africa and providing components for the Italian production line.

In February 2004, Agusta announced that assembly of the Koala would be transferred to Agusta Aerospace Corporation's Philadelphia, Pennsylvania facility during 2004. This duly begun, with N31HH (c/n 14050) being first flown 13 June 2005, although US production certificate not awarded until 24 August 2006, applying to c/n 14517 (74th production) and subsequent aircraft; previous machines assembled in US received Italian export certification. A new 3,716 m² (40,000 sq ft) assembly plant has an initial capacity of 15 to 20 A 119s per year.

CURRENT VERSIONS: **A 119:** *as described.*
A 119 Military: Multirole military variant.

CUSTOMERS: Total of 76 production helicopters (78 overall) completed by December 2006; produced in Italy by late 2004 (including prototypes, but not two rebuilds). Assembly now in US.

Six ordered by Omniflight Helicopters in February 1996; orders and options totalled more than 45 by January 2003 from customers in Europe, North and South America and the Far East. Southeast Mississippi Air Ambulance District of Hattiesburg, Mississippi, took delivery of one in EMS configuration in February 2002. Interest shown by Carabinieri (Italian military police) as replacement for AB 206 and Guardia di Finanza (customs) as NH 500 replacement. Recent customers include the Pennsylvania State Police Department, which ordered two in January 2003, New York City Police's Department of Aviation, which ordered four in February 2003, of which the first was delivered in July 2004, Tex-Air Helicopters, which ordered 10 in June 2003, of which the first three were scheduled for delivery in late 2003, for offshore operations in the Gulf of Mexico, Zhengzhou Police of China, which has ordered one, J V Gokal & Co of India, which has ordered two, Phoenix Police Air Support Unit, which has ordered three, of which the first was delivered on 26 February 2006, the Mexican Government, which ordered five in July 2006, Skyline Helicopters of British Columbia, Canada, which ordered one in February 2006, Aerolineas Ejecutivas SA of Mexico which ordered one in August 2006, Kaan Air of Turkey, which took delivery of one in June 2006 and will receive another in 2007, Libyan Red Crescent, which ordered five in December 2006 for EMS duties, and SEACOR Holdings/ERA Helicopters, which took delivery of one on 15th December 2006.

COSTS: USD1.85 million (2000).
DESIGN FEATURES: Fully articulated four-blade composites main rotor with titanium hub, composites material grips and elastomeric bearings; two-blade tail rotor; large underfin.

STRUCTURE: Aluminium alloy fuselage.
LANDING GEAR: Fixed skids.

POWER PLANT: One Pratt & Whitney Canada PT6B-37A turboshaft rated at 747 kW (1,002 shp) for T-O, and 650 kW (872 shp) maximum continuous. Transmission rating 671 kW (900 shp) for take-off and maximum continuous. Standard three-cell fuel system, combined capacity 606 litres (160 US gallons; 133 Imp gallons); optional four- and five-cell fuel tanks, combined capacities respectively 721 litres (188 US gallons; 156.5 Imp gallons) and 871 litres (230 US gallons; 191.5 Imp gallons).

ACCOMMODATION: Pilot and passenger in front; six passengers in main cabin in three-abreast club configuration; flight-accessible baggage compartment in cabin; main baggage compartment in rear fuselage with optional extensions; in EMS configuration can



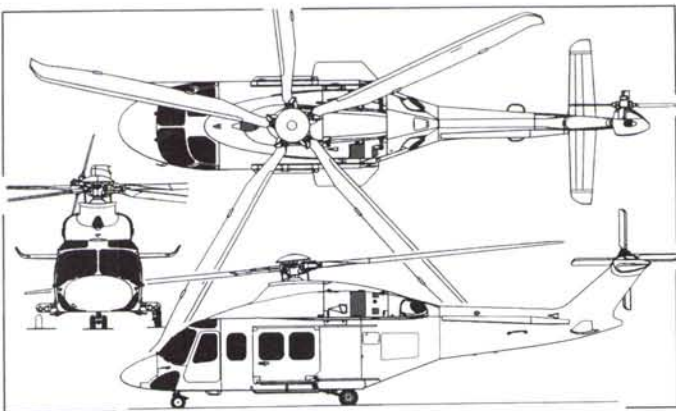
AgustaWestland A 119 Koala

1040534



AgustaWestland AW139 supplied to Irish Air Corps in 2006

1040530



General arrangement of the AgustaWestland AW139 (Paul Jackson)

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be configured for four, five, six or seven seats in club configuration. Alternatively, six stretchers and four attendants in medevac configuration. Plug-type sliding door on each side of cabin, with separate crew doors.

SYSTEMS: Systems duplicated and separated. Smart Zapper chip detection system for main transmission, intermediate and tail rotor gearboxes.

AVIONICS: Honeywell Primus Epic as core system. Provision for up to four 203 × 254 mm (8 × 10 in) high definition colour active matrix liquid crystal displays for MFD, PFD and FLIR/video functions, and four-axis modular digital autopilot with flight director for hands-off operation and SAR modes.

Optional avionics include search/weather radar, multiband radio, EGPWS, TCAS, CVR/FDR, FLIR, and auto-deployable ELT.

EQUIPMENT: Optional equipment includes auxiliary fuel tank, four bag flotation system, two 17-man externally mounted life rafts, external cargo hoist and hook, Nightstar SX-16 searchlight, NVG compatible cockpit, wire strike protection, and removable cabin windows for weapon mounts.

DIMENSIONS, EXTERNAL:

Main rotor diameter	13.80 m (45 ft 3 3/4 in)
Tail rotor diameter	2.69 m (8 ft 10 in)
Length overall, rotors turning	16.66 m (54 ft 8 in)
Fuselage: Length	13.53 m (44 ft 4 3/4 in)
Max width: across cabin	2.26 m (7 ft 5 in)
across sponsons	3.20 m (10 ft 6 in)
Height, rotors turning	4.95 m (16 ft 3 in)
Distance between rotor centres	8.41 m (27 ft 7 in)
Tail rotor ground clearance	2.34 m (7 ft 8 in)
Wheel track	3.05 m (10 ft 0 in)
Wheelbase	4.34 m (14 ft 3 in)
Cabin doors (two, each): Height	1.35 m (4 ft 5 in)
Width	1.68 m (5 ft 6 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.70 m (8 ft 10 1/4 in)
Max width	2.00 m (6 ft 6 3/4 in)
Max height	1.42 m (4 ft 8 in)
Volume	8.0 m ³ (283 cu ft)
Baggage compartment volume	3.4 m ³ (120 cu ft)

AREAS:

Main rotor disc	149.57 m ² (1,610.0 sq ft)
Tail rotor disc	5.52 m ² (59.37 sq ft)

WEIGHTS AND LOADINGS:

Typical equipped weight:	
Law enforcement	3,946 kg (8,700 lb)
Executive transport	3,950 kg (8,708 lb)
Offshore, SAR, maritime security	4,037 kg (8,900 lb)
Typical payload:	
Law enforcement	2,454 kg (5,410 lb)
Executive transport	2,450 kg (5,401 lb)
Offshore, SAR, maritime security	2,363 kg (5,210 lb)

Useful load	2,500 kg (5,512 lb)
Max external load	2,700 kg (5,952 lb)
Max T.O weight	6,400 kg (14,110 lb)
Max disc loading	42.79 kg/m ² (8.76 lb/sq ft)
PERFORMANCE (estimated):	
Never-exceed speed (VNE)	167 kt (309 km/h; 192 mph)
Max cruising speed	157 kt (291 km/h; 181 mph)
Max rate of climb at S/L	610 m (2,000 ft)/min
Service ceiling	6,095 m (20,000 ft)
Service ceiling, OEI	3,595 m (11,800 ft)
Hovering ceiling OGE	1,675 m (5,500 ft)
Max range, no reserves	550 n miles (1,018 km; 632 miles)
Endurance	5 h
Typical SAR mission, with auxiliary fuel, at 50 n miles (93 km; 58 mile) distance to search area, 30 min reserves:	
Time to reach search area	18 min
Time on station	3 h 36 min
Rescue of six survivors	20 min
Time to return to base, best range speed	22 min

AGUSTAWESTLAND AW149

TYPE: Multirole medium helicopter.

PROGRAMME: In October 2003, Agusta revealed preliminary plans for a 6.8 tonne multirole helicopter which it planned to offer to Australia as part of the AgustaWestland/BAE Systems combined bid for the Air 9000 requirement complementing, and in the long term possibly replacing, Sikorsky S-70A Black Hawks. The helicopter appeared to be a reactivation of the A129 Utility project, which Agusta allowed to lapse in the mid-1990s. Australia was offered participation in design of the cabin and tailboom, but the helicopter was not selected for the RAAF.

In November 2005, AgustaWestland released further — but still incomplete — details of the A149, following this with a formal AW149 launch at Farnborough on 22 June 2006. First flight due 2009; civil IFR one/two pilot certification in 2011. Industrial partners being sought in 2006.

DESIGN FEATURES: Affordable multipurpose medium helicopter for military and para-public roles, operable throughout the World. Incorporates new components, structure and systems.

LANDING GEAR: Tricycle type; retractable.

POWER PLANT: Two turboshafts, each in 1,491 kW (2,000 shp) class. Transmission rating 1,252 kW (1,679 shp) for T.O. Engine air particle separator standard. Closed circuit refuelling system. Crashworthy, self-sealing fuel tanks.

ACCOMMODATION: Two crew and up to 15 passengers or 12 fully equipped troops. Sliding door each side of cabin; crew door each side, forward-hinged.

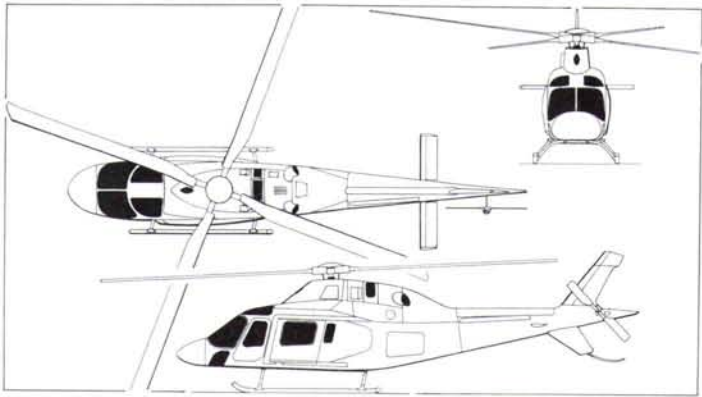
SYSTEMS: Four-axis autopilot. Air conditioning. Optional de/anti-icing. Health and usage monitoring system.

AVIONICS: *Comms:* Cockpit voice recorder. Emergency locator system.



Artist's impression of AgustaWestland AW149

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AgustaWestland A 119 Koala (one P&WC PT6B turboshaft) (Paul Jackson) 0137339

accommodate two stretchers and three medical attendants. Large sliding doors on each side of main cabin; forward-hinged door to cockpit on both sides. Cabin is heated, air conditioned and soundproofed.
AVIONICS: Bendix/King Silver Crown suite and integrated instrument display system (IIDS) standard.

Comms: Silver Crown com/nav and ELT standard.
Flight: Three-axis autopilot with duplex SAS and altitude hold mode standard; radar altimeter, Garmin GNS 430/530 GPS and moving map display optional.
Instrumentation: Third generation NVG compatibility optional.
EQUIPMENT: Optional equipment includes 500 kg (1,102 lb) or 1,000 kg (2,205 lb) fixed cargo hook; 450 kg (992 lb) rescue hoist; Simplex 323 fire attack system with 1,200 litre (317 US gallon; 263.9 Imp gallon) capacity; snow skids, external emergency floats, particle separator, Spectrolab SX-5 searchlight and FLIR/LTV camera.

DIMENSIONS, EXTERNAL:

Main rotor diameter	10.83 m (35 ft 6½ in)
Tail rotor diameter	2.00 m (6 ft 6¾ in)
Length overall, rotors turning	13.01 m (42 ft 8¼ in)
Height overall	3.77 m (12 ft 4½ in)
Fuselage: max width	1.67 m (5 ft 5¾ in)
Width overall, rotor in 'X'	7.66 m (25 ft 1½ in)
Main rotor tip ground clearance	2.54 m (8 ft 4 in)
Tail rotor tip ground clearance	1.29 m (4 ft 2¾ in)
Fuselage ground clearance	0.54 m (1 ft 9¼ in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.10 m (6 ft 10¾ in)
Max width	1.67 m (5 ft 5¾ in)
Max height	1.28 m (4 ft 2½ in)
Floor area	2.60 m² (28.0 sq ft)
Volume, incl flight deck	4.96 m³ (175.2 cu ft)
Baggage compartment: Length	2.30 m (7 ft 6½ in)
Volume	0.95 m³ (33.5 cu ft)

AREAS:

Main rotor disc	92.12 m² (991.6 sq ft)
Tail rotor disc	3.14 m² (33.82 sq ft)

WEIGHTS AND LOADINGS:

Basic weight empty	1,430 kg (3,153 lb)
Max T-O weight: internal load	2,720 kg (5,996 lb)
external load	3,150 kg (6,944 lb)
Max disc loading:	
internal load	29.53 kg/m² (6.05 lb/sq ft)
external load	34.19 kg/m² (7.00 lb/sq ft)
Transmission loading at max T-O weight and power:	
internal load	4.05 kg/kW (6.65 lb/shp)
external load	4.69 kg/kW (7.71 lb/shp)

PERFORMANCE (max internal load):

Never-exceed speed (VNE)	152 kt (281 km/h; 174 mph)
Max level speed	139 kt (257 km/h; 160 mph)
Hovering ceiling: IGE	4,450 m (14,600 ft)
OGE	3,261 m (10,700 ft)
Service ceiling	6,100 m (20,000 ft)
Range with max auxiliary fuel, at 1,525 m (5,000 ft), no reserves	560 n miles (1,037 km; 644 miles)
Endurance	5 h 45 min

AGUSTAWESTLAND AW139

TYPE: Multirole medium helicopter.

PROGRAMME:

DEVELOPMENT MILESTONES

Announced	8 Sep 98
Mockup unveiled	12 Jun 99
First flight	3 Feb 01
Assembly of production aircraft began	Nov 01
Certification	20 Jun 03

Announced at Farnborough Air Show, 8 September 1998, as joint venture under Bell/Agusta partnership; designated AB139; to complement, rather than replace, Bell 412. Full-scale mockup unveiled at Paris Air Show 12 June 1999. AgustaWestland responsible for development, certification to JAR/FAR 29 and transition to production, with participation by Bell on a 75:25 per cent work-share basis; final assembly by



Spectacularly decorated AgustaWestland AW139 owned by a South African businessman 1040541

AgustaWestland at Vergiate, and by Bell (possibly at Mirabel, Canada) for American and Pacific Rim customers. In December 2005, this agreement cancelled and AgustaWestland announced plans to acquire Bell's share of the programme and make its own provision for a US production line in Philadelphia.

No designated "prototype"; first preproduction aircraft (01, later I-ACOI) undertook maiden flight on 3 February 2001 followed by second aircraft (02, later I-ATWO) on 4 June 2001 and third (03, later I-EPIC) on 22 October 2001. Assembly of first production aircraft began in late November 2001; this (I-ANEW) demonstrated at Farnborough in July 2002. Three preproduction aircraft and one tie-down helicopter (TDH) undertook flight test programme leading to Italian certification on 20 June 2003, following 1,600 hour ground and flight test programme (including those flown by first preproduction aircraft which was lost in crash on 22 April 2002) and 750 hours completed on the TDH. FAA certification achieved 20 December 2004. Change of designation to AW139 revealed 23 February 2006 with purchase of 12 by Japanese dealer, Mitsui Bussan. First AW139 assembled by North American subsidiary in Philadelphia was N915DH c/n 31057, handed-over to SEACOR Holdings/ERA Helicopters on 15 December 2006.

Risk-sharing collaborators include GKN Westland (tail rotor drive train), Honeywell (avionics), Kawasaki (transmission input module), Liebherr Germany (landing gear and air conditioning system), Pratt & Whitney Canada (power plant) and PZL Świdnik (airframe components).

CUSTOMERS: More than 150 ordered by more than 40 customers by November 2005. Launch customer Bristow Helicopters of UK announced order for two on 26 September 2000 for delivery in 2003. Hawker Pacific ordered four on 12 February 2001 for corporate, utility and offshore operations in the Arabian Gulf. Customers include the government of Namibia, which ordered two for VIP and multimission duties, of which the first was delivered on 16 September 2004; the Aga Khan Development Network (AKDN), which has ordered four for operations in South and Central Asia in connection with construction of three University of Central Asia campuses; Evergreen International, which ordered two in June 2003; ChevronTexaco, three for offshore operations, the first of which was delivered on 6 February 2005 during the HAI Convention in Anaheim, California; Evergreen Helicopters, the first of which was also delivered on 6 February 2005; Seacor Holdings Inc, which ordered 20 on 7 February 2005 for its Era Helicopters subsidiary for offshore operations; the United Arab Emirates Air Force, eight, six of which will be in SAR configuration and two assigned to VIP transport; Abu Dhabi Aviation, which took delivery of one in VIP configuration during the Dubai Airshow in November 2005 and Estonian Border Guard, one ordered November 2005.

Selected for US Coast Guard 'Deepwater' programme vertical take-off/landing recovery and surveillance (VRS) requirement, with first delivery expected in 2012. Selection by Irish Department of Defence announced 3 December 2004 for Irish Air Corps utility helicopter requirement; firm order for four; initial Irish delivery on 11 August 2006 in Italy as first to a military customer; entered service in Ireland (two aircraft) 28 November 2006. Anticipated market for 900 over 20 years, some 55 per cent for military use; 34 per cent of sales projected in Europe, 23 per cent in Middle East, 18 per cent in Far East, 13 per cent in South America and 12 per cent in North America.

COSTS: Commercial version USD7 million (2002). Estimated direct operating cost based on North American operation, USD757.30 per hour (2003).

DESIGN FEATURES: Design goals include high manoeuvrability and agility, low pilot workload, night/all-weather operation, low acoustic and infra-red emissions and mission flexibility for commercial and military operators. Intended for offshore support, medevac, corporate/VIP transport, SAR and military operations. Able to operate at maximum T-O weight from Class A helipads at 945 m (3,100 ft) at ISA + 20°C. Five-blade, fully articulated, ballistic tolerant main rotor and four-blade tail rotor. Some transmission and rotor elements based on AgustaWestland A129 Mangusta. Upturned tips added to horizontal stabilisers of production aircraft.

FLYING CONTROLS: Four-axis, digital AFCS.

LANDING GEAR: Heavy-duty, retractable tricycle type with twin wheels on nose unit; single wheels on main units, which retract into side sponsons.

POWER PLANT: Two Pratt & Whitney Canada PT6C-67C turboshafts, with FADEC, each rated at 1,252 kW (1,679 shp) for T-O and 1,142 kW (1,531 shp) maximum continuous; OEI ratings 1,396 kW (1,872 shp) for 2.5 minutes and 1,252 kW (1,679 shp) maximum continuous. Fuel tanks behind main cabin. Main transmission can run for up to 30 minutes without oil.

ACCOMMODATION: Up to 15 passengers on crashworthy seats in three rows of five, two forward facing, one rearward facing, in unobstructed cabin with flat floor; flight-accessible baggage compartment at rear of cabin (base of tailboom). In executive configuration the cabin can

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Radar: Optional weather radar in chin pod.
Flight: Flight data recorder.
Instrumentation: Fully integrated avionics system based on MIL-STD-1553B databus with four 152 × 203 mm (6 × 8 in) active colour matrix LCDs.
Mission: FLIR; NVG compatible lighting.
Self-defence: Defensive aid subsystems.

EQUIPMENT: Emergency flotation system. External electrical hoist kit of 272 kg (600 lb) capacity, with utility hoist light. Wire strike protection. Optional, modular ballistic protection kits.

ARMAMENT: Outrigger pylons attached to lower, rear cabin sides; braced to top of cabin. Options include seven-, 12- and 19-tube rocket launchers for 70 mm and 81 mm weapons; window-mounted 7.62 mm machine gun; external pods for 12.7 mm and 20 mm machine guns; air-to-ground and air-to-air missiles.

DIMENSIONS, EXTERNAL:

Main rotor diameter	14.00 m (45 ft 11¼ in)
Length overall, rotors turning	16.91 m (55 ft 5¾ in)
Height overall	5.05 m (16 ft 6¾ in)

DIMENSIONS, INTERNAL:

Cabin: Length	3.00 m (9 ft 10 in)
Max width	2.26 m (7 ft 5 in)
Max height	1.45 m (4 ft 9 in)
Volume	10.0 m ³ (353 cu ft)
Baggage hold volume	4.0 m ³ (141 cu ft)

AREAS:

Main rotor disc	153.9 m ² (1,657.0 sq ft)
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WEIGHTS AND LOADINGS:

Max underslung load	3,000 kg (6,614 lb)
Max T-O weight	7,000-8,000 kg (15,432-17,637 lb)

PERFORMANCE:

Max cruising speed	160 kt (296 km/h; 184 mph)
Hovering ceiling, OGE at 35° C (95° F)	1,830 m (6,000 ft)
Range with 12 troops	more than 500 n miles (926 km; 575 miles)

AGUSTA-BELL 412 and GRIFFON

Swedish military designation: Hkp 11

TYPE: Multirole medium helicopter.

PROGRAMME: First flight of Bell 412SP (in USA) August 1979; deliveries started January 1981; Agusta licensed production of civil version started 1981; first flight of military Griffon August 1982; deliveries began January 1983; Bell 412HP certified 29 June 1990; Bell 412EP is a civilian version currently manufactured under licence by AgustaWestland.

CURRENT VERSIONS: **Griffon:** Military derivative developed for direct fire support, scouting, assault transport, equipment transport, SAR and maritime surveillance.

Creso: Battlefield surveillance version; trial installation for Italian Army in AB 412 MM81196 as an element (with Mirach 26 UAVs and other sensors) of the 'CATRIN C'1 system. FIAR Creso E-band MTI radar in a circular radome below the nose, plus Elettronica emitter locators at the nose and on the tailboom. Galileo FLIR turret above pilot's seat. Maximum operational altitude of 1,500 m (4,920 ft) gives radar range of 39 to 49 n miles (72 to 91 km; 45 to 56 miles). First flight of operational system mid-1996; Creso is Italy's contender in the NATO Alliance Ground Surveillance programme.

CUSTOMERS: Some 294 produced by early 2006. Those in Italy include Army (24), Carabinieri (37), Coast Guard (10), national fire service (23), national forest service (12) and Guardia di Finanza (22). Exports to Zimbabwe Air Force (10), Ugandan Army (six), Finnish Coast Guard (four); Royal Netherlands Air Force (three); Dubai Air Force (three or more); Ghana Air Force (two, in EMS configuration); Royal Saudi Air Force (in parallel with Bell-built 412SAs); Swedish Army (five); and Dubai Police (two). Eritrean Air Force (four). Lesotho Defence Force (two). Abu Dhabi Air Force (three). Eventual 14 ordered for SAR by Turkish Coast Guard, beginning in late 1999.

COSTS: Five Turkish Coast Guard, total cost USD52 million (1999).

DESIGN FEATURES: Griffon has reinforced impact-absorbing landing gear, selective armour protection and differences noted below.

POWER PLANT: One Pratt & Whitney Canada PT6T-3D Twin-Pac rated at 1,342 kW (1,800 shp) for T-O and 1,194 kW (1,600 shp) maximum continuous (single-engine ratings 850 kW; 1,140 shp for 2½ minutes and 723 kW; 970 shp continuous). Transmission rating 1,181 kW (1,584 shp) for 5 minutes, 846 kW (1,135 shp) maximum continuous and 850 kW (1,140 shp) single engine. IR emission reduction devices optional. Fuel capacity 1,249 litres (330 US gallons; 275 Imp gallons). Two 75.7 or 341 litre (20.0 or 90.0 US gallons; 16.7 or 74.9 Imp gallon) auxiliary fuel tanks optional; single-point refuelling.

ACCOMMODATION: One or two pilots on flight deck, on energy-absorbing, armour-protected seats. Fourteen crash-attenuating troop seats in main cabin in personnel transport roles, six patients and two medical attendants in ambulance version, or up to 1,814 kg (4,000 lb) of cargo or other equipment. Space for 181 kg (400 lb) of baggage in tailboom. Total of 51 fittings in cabin floor for attachment of seats, stretchers, internal hoist or other special equipment.

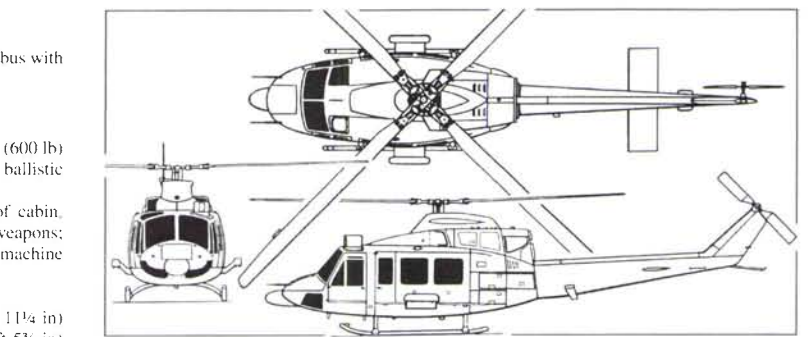
SYSTEMS: Generally as for Bell 212/412.

AVIONICS: Optional four-screen EFIS.

EQUIPMENT: SAR and coastal surveillance versions equipped with 360° panoramic search radar integrated with FLIR and TV; video and still camera systems; datalink; dual digital four-axis AFCS with auto approach to hover, mark on target and search pattern; dual GPS; EFIS-LCD IFR cockpit instrumentation; operator's console in passenger compartment; gyrostabilised binoculars; searchlight and rescue light; electric rescue hoist; life rafts and lightweight emergency floats. BAE Systems MST-S multisensor turret system supplied for undisclosed AB 412EP customer in 1996, to operate in conjunction with Honeywell RDR-1500 maritime surveillance radar.



Agusta-Bell 412HP of Italian Customs service (Paul Jackson)



Agusta-Bell 412 Griffon military helicopter (Dennis Punnett)

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ARMAMENT: Wide variety of external weapon options for Griffon include swivelling turret for 12.7 mm gun, two 25 mm Oerlikon cannon, four or eight TOW anti-tank missiles, two launchers each with nineteen 2.75 in SNORA or twelve 81 mm rockets, 12.7 mm machine guns (in pods or door-mounted), four air-to-air or air defence suppression missiles, or, for attacking surface vessels, four Sea Skua or similar air-to-surface missiles.

DIMENSIONS: As for Bell 212/412

WEIGHTS AND LOADINGS:

Weight empty, equipped (standard configuration)	2,914 kg (6,425 lb)
Max T-O weight	5,398 kg (11,900 lb)
Transmission loading at max T-O weight and power	4.57 kg/kW (7.51 lb/shp)

PERFORMANCE:

Never-exceed speed (VNE) at S/L	140 kt (259 km/h; 161 mph)
Cruising speed: at S/L	122 kt (226 km/h; 140 mph)
at FL15	125 kt (232 km/h; 144 mph)
at FL30	123 kt (228 km/h; 142 mph)
Max rate of climb at S/L	542 m (1,780 ft)/min
Rate of climb at S/L, OEI	168 m (551 ft)/min
Service ceiling, 30.5 m (100 ft)/min climb rate	5,395 m (17,700 ft)
Service ceiling, OEI, 30.5 m (100 ft)/min climb rate	2,320 m (7,620 ft)
Hovering ceiling: IGE	3,110 m (10,200 ft)
OGE	1,585 m (5,200 ft)
Range with max standard fuel at appropriate cruising speed (see above), no reserves:	
at S/L	354 n miles (656 km; 407 miles)
at FL15	402 n miles (745 km; 463 miles)
at FL30	434 n miles (804 km; 500 miles)
Max endurance: at S/L	3 h 36 min
at FL15	4 h 12 min

AGUSTAWESTLAND EH101

Royal Navy designation: Merlin HM. Mk 1 and 2
RAF designation: Merlin HC. Mk 3
Canadian Forces designation: CH-149 Cormorant
United States Navy designation: VH-71A
TYPE: Multirole medium helicopter.

PROGRAMME:

DEVELOPMENT MILESTONES

Requirement issued	80
Official go-ahead	25 Jan 84
First order (Royal Navy)	9 Oct 91
First flight	9 Oct 87
Certification	24 Nov 94
First flight production	6 Dec 95
First delivery (Royal Navy)	12 Nov 98
Entered service (Royal Navy)	2 Jun 00

Stems from Westland WG 34; selected in mid-1978 by UK MoD to meet SR(S) 6646 for a Sea King replacement; broadly similar requirement by Italian Navy led to 1980 joint venture with Agusta; subsequent market research confirmed compatibility of basic design with commercial payload/range and tactical transport/logistics requirements, resulting in decision to develop naval, civil and military variants based on common airframe.

Nine month project definition phase approved by UK/Italian governments 12 June 1981; full programme go-ahead announced 25 January 1984; design and development contract signed 7 March 1984; selected by Canadian government August 1987; Italian-built iron bird ground test airframe followed by nine preproduction aircraft (PP1-9; see Current Versions); RTM 322 engines selected for RN Merlin June 1990; T700-GE-T6A engines selected for Italian Navy version September 1990; fourth UK/Italian government MoU signed 30 September 1991 (starting industrialisation phase); UK MoD commitment to 44 Merlins 9 October 1991; Canadian order for 50 (35 CH-148 and 15 CH-149) announced 24 July 1992; UK and Italian civil certification of Srs 300 and 500 planned for late 1993, but eventually achieved on 24 November 1994; US FAA approval gained on following day.

Flight testing halted following January 1993 loss of PP2; resumed 24 June 1993. USD1 million study completed for US Marine Corps, 1993, assessing EH101 as 30-troop or cargo transport as fallback in event of Bell/Boeing MV-22 cancellation. First flight with RTM 322 engines, 6 July 1993; two aircraft flew total of 260 hours for development. Canadian requirement cut to 43 by deletion of seven CH-148s in August 1993 as cost-saving measure, but incoming government cancelled entire programme on 4 November 1993, despite award of substantial offsets to Canadian firms. UK government confirmed EH101 as next RAF tactical transport helicopter on 1 December 1993; formal announcement of order for 22 made 9 March 1995; Italian order confirmed October 1995 for 16, plus eight options. First production aircraft, RN01/ZH821 for Royal Navy, first flew 6 December 1995 and officially rolled out on 6 March 1996, although lacking mission avionics. Military Aircraft Release trials began in May 1998, using RN02/ZH822 (first flight 14 January 1997) and the first iteration of the Release was issued in the last quarter of 1998, allowing the start of Intensive Flight Trials with the commissioning of No. 700M Squadron (the Merlin IFTU) at RNAS Culdrose on 1 December 1998, and of RN aircrew training. First Merlin transferred to RN charge was RN05/ZH825 on 12 November 1998; first to civil customer, March 1999; first production EH101 for Italian Navy flew 6 December 1999; first squadron (824 NAS, Royal Navy) commissioned 2 June 2000 at RNAS Culdrose.

Canada and UK suspended flight operations on 5 April 2004, following destruction of Royal Navy Merlin at Culdrose on 30 March, almost certainly caused by tail rotor assembly



Italian EH101 (MM81495) arriving at Patuxent River as test vehicle for VH-71 variant (US Navy)

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failure. Subsequent modification of tail rotor half hub assembly cleared way for gradual return to flight status in early June, but Canadian aircraft still encountering problems with cracks in early part of 2006, with these impacting negatively on aircraft availability and capability.

Hand-over of 101st EH101 (fourth for Portugal) effected 15 April 2005 and ferried to Portugal on 21 April.

CURRENT VERSIONS: **Srs 100/Naval:** Primary roles ASW, ASV, anti-ship surveillance/tracking, amphibious operations and SAR; others include AEW, vertrep and ECM (deception, jamming and missile seduction); designed for autonomous all weather operation from land bases, large and small vessels (including merchant ships) and oil rigs and, specifically, from a 3,500-tonne frigate, with dimensions tailored to frigate hangar size. Capabilities include Type 23 frigate launch and recovery in conditions up to Sea State 6 with ship on any heading and windspeed (from any direction) up to 50 kt (93 km/h; 57 mph); endurance and carrying capacity includes ability to operate for up to 5 hours with state-of-the-art equipment and weapons.

Italian Navy ASW/ASVW/Mk 110: Operates from shore bases and aircraft or helicopter carriers against surface and underwater targets with HELRAS dipping sonar; armed with two Marte Mk 2/S ASMs. First of eight (MM81480 '2-01') flew on 4 October 1999; first two delivered December 2000 for service trials; four more handed over by end of 2001.

Italian Navy AEW/Mk 112: Requirement revealed in 1994 for AEW helicopter. Four ordered in 1995, with first for delivery in 2003-04. Also known as ASVW/E (Anti-Submarine and Vessel Warfare, Enhanced), MM/APS-784 based Eliradar HEW-784 air and surface surveillance radar, radome almost doubled in size (from 1.80 m; 5 ft 10 3/4 in) to accommodate 3.00 m (9 ft 10 in) antenna, but other avionics similar to Italian Navy Mk 110. Initial aircraft, MM81488 '2-09', shown at Paris, 15-22 June 2003.

Merlin HM, Mk 1/Mk 111: Royal Navy ASW version for Staff Requirement (Sea) 6646; Lockheed Martin (formerly Loral) ASIC is prime contractor for systems integration; operates from Type 23 frigates, 'Invincible' class aircraft carriers, RFAs and other ships, and land bases. Initial production aircraft, RN01/ZH821, first flew 6 December 1995; second, RN02/ZH822, first with mission avionics, flew 14 January 1997. Of first seven production Merlins, RN01 and RN02 initially assigned to operational performance acceptance procedure (OPAP) trials at the fully instrumented Atlantic Underwater Test and Evaluation Center (AUTC) in Bahamas, 1998-99, and to assistance in sea trials: RN03 to DTEO, Boscombe Down, in September 1997 for military aircraft release trials; joined by RN02 for pre-IFTU stage of release, achieved November 1998. The fully instrumented RN04 followed in late 1997; RN05-RN08 formed Intensive Flight Trials Unit (No. 700M Squadron) on 1 December 1998; PP5, RN02 and RN03 underwent operational tests at AUTC from February 1999 (Operation Pearly King). Subsequent deep water trials were undertaken from Benbecula in 1999. In April 2000, RN12 from Boscombe Down and RN17 from Culdrose undertook extended Ship Helicopter Operational Limit trials aboard RFA *Argus*, experiencing winds of up to 50 kt (93 km/h; 58 mph) and up to Sea State 10. Snow and icing trials accomplished by RN aircraft in Canada in first half of 2001.

RN02, RN03 and RN14 undertook ASuW trials from Benbecula from late June 2000, following 30-day series of ASW tests off Bahamas, during Operation 'Trial Wizard' in March-April 2000. These included dropping eight Sting Ray torpedoes and 800 sonobuoys.

By the end of 1998, the Royal Navy had seven Merlins including two with No. 700M Squadron, which received its third on 21 April 1999. 700M evolved from IFTU to OEU on 1 September 2001. Training role to No. 824 Squadron at Culdrose on 2 June 2000, with No. 814 Squadron forming as the first front line squadron on 5 October 2001 for deployment aboard HMS *Ark Royal*. Embarked operational capability achieved in second quarter of 2002 with four helicopters, although complement will rise to six in late 2006. The aircraft also equips a small-ships squadron (No. 829, reformed 21 October 2004 with six Merlins) and a second carrier squadron, No. 820, which officially reformed at Culdrose on 5 December 2003. The Royal Navy received its 25th Merlin in August 2000 and 35 had been delivered by September 2001, with the 44th and last example handed over in December 2002.

Operational debut made in 'Telic' (UK contribution to Iraq conflict of 2003), when four helicopters of 814 Squadron deployed to Gulf aboard RFA *Fort Victoria*; primarily engaged in anti-surface warfare mission, but also undertook vertical replenishment, troop transport and Long-range delivery tasks; lack of ASW requirement permitted removal of dipping sonar, making more space available in cabin. Over 800 hours accumulated in combat conditions, with just one sortie lost because of unserviceability.

In June 2003, Lockheed Martin UK Ltd selected to undertake two-year study programme and awarded GBP18 million contract for assessment phase of Merlin Capability Sustainment Plus (MCSP) project intended to address obsolescence issues and weapon system upgrades, including operational aspects arising from combat experience in the Gulf. Cost savings to figure prominently, with increased use of COTS (commercial off-the-shelf) equipment and open system computer architecture. In January 2006, it was announced that Lockheed Martin UK Ltd had been awarded a GBP750 million contract covering upgrade of 30 Merlins with options for up to eight more. In addition to upgrading avionics equipment, this programme also entails introduction of HEAT (Helicopter Electro Actuation Technology), this being a third-generation fly by wire system which makes use of electrical rather than hydraulic units in controlling Merlin rotor systems. Enhancement of acoustic processing systems likely to be undertaken by Thales UK, which selected by prime contractor Lockheed Martin in mid-2006 and awarded initial GBP27 million contract. Upgraded helicopters, which could be designated Merlin HM, Mk 2, anticipated to enter service in 2013.

Merlin AEW: UK MoD-funded study, submitted August 1998, of possible Sea King AEW, Mk 7 replacement to meet Royal Navy's FOAEW requirement. Ventral radome and stub-wings; latter would permit speeds up to 250 kt (463 km/h; 288 mph).

Heliliner (Srs 300): Commercial variant intended to offer 360 n mile (666 km; 414 mile) range, with full IFR reserves, carrying 30 passengers and baggage; flight crew of two, provision for cabin attendant, stand-up headroom, airline-style seating, overhead baggage stowage, full environmental control, passenger entertainment, and provision for lavatory and galley. Category A VTO performance, capable of offshore/oil rig operations or scheduled flights into city centres at high altitudes under more rigorous future civil operating rules; rear-loading ramp optional.

Military Utility (Srs 400): Tactical or logistic transport variant with rear-loading ramp; able to airlift 6 tons or up to 30 combat-equipped troops. See Italian Navy and Merlin headings below. Naval equivalent (Srs 200) lacks ramp. Tail- and rotor-folding Utility version under consideration, with role options including mine countermeasures, towing EDO Mk 106 sled.



Advanced technology testbed EH101 G-17-510 displays its BERP IV rotor blades during maiden flight in this configuration on 26 September 2006

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Manufactured image of minesweeping gear being deployed from AgustaWestland EH101 AMCM version

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Italian Navy Utility/Mk 410: Based on rear-ramp Srs 400, but with Galileo Avionica Galiflir FLIR (also specified for other Italian versions), cargo hook, basic avionics and Elettronica ESM/ECM and Self Defence suite similar to Italian ASW version. Weather radar. Four ordered in 1995. Serves in the commando support role with Nucleo Elicotteristico per la Lotta Anfibia at Grottaglie. First aircraft, MM81492 '2-13', made public debut at Farnborough International, July 2004. Italian Air Force also has requirement for EH101s to replace two AS-61A-4 VIP helicopters.

Italian Navy Amphibious Support/Mk 413: Four ordered at beginning of 2002 for support of amphibious assault operations and special forces missions. Features include upgraded avionics for night missions (including NVG compatible cockpit) as well as weather radar, self-protection systems, personnel locator systems and armour and machine guns, plus internal cargo handling system; plumbing for in-flight refuelling equipment will be installed, although it is not intended to fit refuelling probes at present. First two handed over to Italian Navy in mid-2006, with remaining two to follow by end of 2006.

Merlin HC. Mk 3/Mk 411: Bid for RAF contract entered May 1994; revised cockpit layout for low level operations; provision for pintle-mounted machine guns in side doors. Order for 22 announced 9 March 1995, in satisfaction of Staff Requirement (Air) 440. Each has provision for rapid installation of chin-mounted FLIR turret and (non-telescopic) refuelling probe beneath the nose, offset to starboard (though neither routinely fitted). Up-rated engines. Other features include integrated defensive aids system (with Nemesis directional IR countermeasures, AN/AVR-2ArV laser warning and Sky Guardian 200 RWR), NVG compatibility, crash attenuating seats for all occupants (two pilots; loadmaster; optional fourth crewman; and 24 troops), active noise-reduction headsets for all passengers, non-folding main rotor blades and tailboom, improved navigation suite (compared with RN version), variable-speed cargo winch and roller conveyor for cargo handling, SAR hoist to starboard and cargo hook for external loads (installation in floor resulting in slightly reduced fuel capacity). Capable of carrying long wheelbase Land Rover; an overload of 30 troops can board and strap-in within 2 minutes, and deplane within 40 seconds. Critical design review completed July 1997. Assembly of first (RAF01/ZJ117) began November 1997; rolled out 25 November 1998; first flew 24 December 1998. First aircraft delivered to DERA (now QinetiQ) at Boscombe Down 19 January 2000. Sixth aircraft handed over to Defence Procurement Agency on 27 June 2000, this date thereby becoming official acceptance into RAF inventory; formal release to service signed on 11 January 2001. Fifth and sixth aircraft used for conversion of first RAF instructors at Yeovil in June 2000.

Deliveries due between September 1999 (first to Boscombe Down for DTEO trials) and October 2001, but latter date not met (13 received by November 2001). Initial units, from April 2000, were Rotary Wing Operational Evaluation and Training Unit (originally at Boscombe Down) and the Operational Conversion Flight (actually an element of No. 28 Squadron at Benson) with a limited Release-to-Service for day training. Delivery of the first aircraft, due on 6 November 2000, was delayed by a worldwide EH101 grounding, following the loss of an HM. Mk 1, ZJ122 to Benson for technical familiarisation 11 December 2000; formal handover of five aircraft to RAF on 7 March 2001; by mid-June 2001, RAF had six Merlins at Benson, while further seven on flight trials with QinetiQ.

No. 28 Squadron officially re-formed 17 July 2001; is only RAF Merlin squadron and undertook first field deployment during 17–21 September 2001, when participated in exercise 'Pegasus Trial', which included operations from RAF Honington and first practice tactical troop-lift. A new Medium Support Helicopter Aircrew Training Facility, with two Merlin simulators, opened at Benson on 17 July 2000. Final aircraft handed over at Yeovil on 19 November 2002. Full operational capability attained by No. 28 Squadron in first quarter of 2003, with some Merlins deployed to Bosnia later that year. More demanding exposure to operational usage came in 2005, with deployment of No. 1419 Flight and four Merlins to Basra, Iraq; first two helicopters left Benson on 25 February and ferried to Iraq via Cyprus, Jordan and Kuwait, arriving in theatre on 1 March and being joined later by second pair which departed Benson on 7 March. Merlin operating in multirole configuration, with missions undertaken including special forces support, combat search-and-rescue, medical evacuation and airborne command post; in first 800 hours of flight time recorded on deployment, Merlin achieved 89 per cent serviceability record.

RAF expected to increase size of Merlin fleet by six, with delivery of these being accelerated through diversion of final six Danish examples that were due to be handed over in late 2006 and early 2007.

SAR/Utility (Srs 500): For commercial and paramilitary operators requiring rear-loading facility. First production Mk 510 (I-AGWH) built for certification as a 'white tail'; rolled out in Italy 28 May 1997, and flew 17 June. Subsequently used for cold weather trials, from Fairbanks, Alaska, at temperatures from -5 to -32°C (23 to -26°F) until April 2000, and then for hot and high trials in USA. First order in November 1996 for a Mk 510 for Tokyo Metropolitan Police Agency; first flew September 1997; delivered from Italian production in January 1998 as first to civil customer; fitting-out at Kawasaki Heavy Industries was delayed by bankruptcy of original financiers; handed over at Gifu on 25 March 1999.

SAR aircraft for Canada (described separately), Denmark and Portugal among others, are Series 500s. Initial Danish Mk 512 first flew 12 December 2003 with conventional nose, but by public debut at Farnborough International in July 2004, had gained complex radome incorporating radar antenna and, below, fixed EGPWS window, plus chin FLIR turret and side-mounted ESM.

Danish helicopters have RTM322 02/8 turboshafts and dual-processor ASMC (aircraft system management computer) for higher level of systems integration. Avionics include Inmarsat Constellation secure voice satcom, Finding/Personnel Location System (F/PLS), with both global maritime distress safety system and COSPAS/SARSAT), TCAS, EGPWS and wireless intercom. Equipment includes dual electrical hoists, operating table and associated medical apparatus. For alternative troop transport role, Danish EH101s have 16 seats, DIRCM and customer-specific EW suite. Danish variant named **Merlin Joint Supporter** in ceremony, at Yeovil on 25 October 2004; first delivery to Denmark made 10 January 2006.

Portuguese EH101s fitted with ASMC, RTM322-02/8 engines, F/PLS and two hoists, plus ventral radar. SAR-specific equipment includes Nitesun searchlight, SAR Tech seats, provision for six stretchers and 11 troop seats. Additional CSAR equipment comprises EW suite, airborne interrogator and guidance system, folding main and tail rotors and machine gun attachment points at side door and on ramp. Fishery protection (SH-ICAP) variant has data management console with recording capability, plus external loudspeaker. First flight of first Portuguese EH101 12 December 2003; following extensive test and training programme, this handed-over at Vergiate on 22 December 2004.

'CH-X': Offered to USMC; chin gun turret; not adopted.

CH-148 Petrel and CH-149 Chimo: Intended Canadian ASW and SAR versions; cancelled after payment of US\$353 million in compensation.

CH-149 Cormorant/Mk 511: Adaptation of civil EH101 (with ramp) offered to Canada in early 1995 as a CH-113 replacement (in place of the CH 149 Chimo) for SAR missions; selected late 1997. Deck landing capability; reduced cost achieved by reliance on mainly



Royal Air Force AgustaWestland Merlin HC. Mk 2

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Royal Navy AgustaWestland Merlin HM. Mk 1s

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commercial avionics and by original proposed use of twin hoists in single door, rather than one per side. Hoist arrangement subsequently revised, with a primary winch in the starboard door and a secondary in the forward port door. Features Honeywell RDR-1400 radar, Litton LN-100G embedded laser INS/GPS, FLIR, Spectrolab SX-16 searchlight, crashworthy fuel tanks, Breeze-Eastern primary and secondary hoists and an underslung load hook. Planned to include provision for internal extended range tanks (ERTs) and hover in-flight refuelling from ships under way and wire-strike protection.

Total of 15 ordered from Italian production to replace CH-113 Labrador, with deliveries originally to begin in October 2000 and be complete by end of 2002; however, delays in certification and qualification resulted in deliveries being deferred. First Cormorant (149901) flew at Vergiate on 7 March 2000, with an official first flight on 31 May 2000. Assigned to 442 Squadron (19 Wing) at Comox, 413 Squadron (14 Wing) at Greenwood, 424 Squadron (8 Wing) at Trenton and 103 Squadron (9 Wing) at Gander; first two helicopters (149904 and 1905) handed over in Italy on 29 September 2001 and arrived Comox on 11 October 2001. Formal acceptance at Comox on 29 October 2001; CH-149 subsequently certified for operational duty on 15 July 2002, with SAR standby alert duty from 25 July; first operational mission involving successful SAR accomplished 30 July, 413 Squadron received its first CH-149 on 24 August 2002. Deliveries completed in mid-2003.

Estimated to cost 40 per cent less than original CH-149 with 108 per cent offsets ('industrial regional benefits') totalling CAD629 million. Associated industrial team includes Bombardier, Bristol Aerospace, Spar Aerospace and CAE, with Canadian Helicopters to provide a leasing and follow-on maintenance option. EHI demonstrated a 15,500 kg (34,171 lb) MTOW (900 kg; 1,984 lb overweight) which would give a 1,080 n mile (2,000 km; 1,242 mile) SAR radius.

Problems encountered with cracks developing in tail rotor half hubs have necessitated imposition of speed and climb limitations on CH-149, as well as rigorous inspection programme. Cause of cracks still to be established and these still appearing at unpredictable frequency (as low as 15 hours and as high as 800 hours of flight time) despite replacement by newly manufactured assemblies in 2005; it was suspected that vibration was to blame and AgustaWestland was working on redesign of tail rotor in early 2006, but this could require up to four years to complete.

Cormorant MHP: Tentative designation for unsuccessful EH101 subvariant offered by EHI-led 'Team Cormorant' to meet remaining Canadian requirement (Maritime Helicopter Program) for a shipborne ASW Sea King replacement, Sikorsky S-92 selected in July 2004.

KHI-01: Designation allocated by manufacturer to version of EH101 being assembled by Kawasaki Heavy Industries at Gifu, Japan, for service with Maritime Self-Defence Force (MSDF) in mine countermeasures role as MCM101 and Antarctic support role as CH101. Japan committed in June 2003 to purchase initial quantity of 14, but could ultimately acquire about 80. First helicopter produced by AgustaWestland in UK (8651) made initial flight at Yeovil (as G-17-518/ZK112) on 15 February 2005; this shipped to Japan in June 2005 for fitment of radios, defensive aids and other specialised equipment before being delivered to MSDF on 3 March 2006. Remaining 13 helicopters being produced as kits in UK, for final assembly in Japan; first kit delivered to KHI in final quarter of 2005 with second following in first quarter of 2006; delivery of first locally-assembled MCH101 helicopter due in first quarter of 2007, to be followed by first CH101 in second quarter of

same year. Service entry planned for 2007, with 11 MCH101 helicopters earmarked to replace MH-53EJ Sea Dragon, while three CH101s assume responsibility for Antarctic support from S-61A.

US101: Versions optimised for US market, following announcement on 31 October 2001 of agreement between AgustaWestland and Lockheed Martin under which latter will promote the EH101 in the USA as the US101; Bell Helicopter Textron subsequently added to team in May 2003. Initial target was US Navy VXX requirement for total of 23 helicopters to replace VH-3D Sea King and VH-60N in presidential transport role; bids from Lockheed Martin and Sikorsky submitted 2 February 2004, with contract award expected in May 2004, but twice postponed. On 28 January 2005, US101 selected and USD1.79 billion system development and demonstration contract awarded to Lockheed Martin Systems Integration at Owego, New York; VH-71A designation subsequently assigned on 7 July 2005. First five production aircraft will be to so-called Increment 1 standard, with CT7-8E engines and only 250 n mile (463 km; 287 mile) range; initial delivery and IOC set for FY09. Remaining 18 production aircraft to Increment 2 standard, with 2,237 kW (3,000 shp) engines, more sophisticated mission system and 350 n mile (648 km; 402 mile) range. First seven aircraft at least to come from UK production, with majority for assembly by Bell at Amarillo, Texas; final delivery to Marine squadron HMX-1 at Quantico, Virginia, expected in 2014. US101 was unsuccessful candidate to satisfy USAF Personnel Recovery Vehicle (PRV) combat SAR requirement won by Boeing with HH-47 Chinook. In October 2003, Lockheed Martin took delivery of ninth development EH101 at Owego, New York, for use as a demonstrator. First flight with CT7-8E engines rated at 1,864 kW (2,500 shp) and five 254 × 203 mm (10 × 8 in) LCDs announced 6 October 2004 (UK 'B Conditions' registration G-17-510). Engine integration and performance trials under way at Victorville, California, in latter half of 2005. Italian Navy utility variant (MM81495) delivered to Lockheed Martin at Owego in June 2005 on lease; subsequently to Naval Air Test Center at Patuxent River, Maryland, as TV1 (Test Vehicle 1); used to evaluate location of antennae for communications systems and as training aid for aircrew and maintenance specialists in preparation for arrival of three definitive test vehicles in early 2007, at which time TV1 to be returned to Italy.

EH101 BERP testbed: First flight of high-performance variant (conversion of US101 demonstrator G-17-510) at Yeovil on 26 September 2006. Embodies technology of next-stage EH101 improvements, including British Experimental Rotor Programme (BERP) IV main rotor blades, more powerful CT7-8E engines and a new integrated cockpit display system. BERP IV Technology Demonstration Programme (TDP), jointly funded by MoD and AgustaWestland, has objectives comprising reduced first cost, reduced life cycle costs, reduced rotor vibration at high and low speeds, improved hover and forward flight performance, improved damage tolerance, increased erosion resistance and reduced signatures. Up-rated CT7-8E engines, 1,884 kW (2,527 shp) each for take-off, provide 12 per cent more power, increasing payload by at least 907 kg (2,000 lb) hot-and-high. Fully integrated flight and mission cockpit display system utilises five 254 × 203 mm (10 × 8 in) LCD main displays, giving 70 per cent more display area, and is earmarked for Royal Navy's EH101 Merlin MCSP and UK MoD Future Lynx fleet.

CUSTOMERS: Orders totalled 165 (including 23 VH-71A) in April 2005; see table.

Total 66 for UK, comprising 44 Royal Navy Merlins and 22 RAF Merlins, Italian Navy ordered 16 (reduced from 36, and then from 24), comprising eight ASW (and ASV) versions, four AEW versions and four marines tactical transports with blade- and Tail-folding; option on four of further eight converted to firm order at start of 2002. Westland produced one Merlin in 1995, three in 1997, six in 1998, 13 in 1999 and 12 in 2000; Agusta built two civil EH101s in 1997 and delivered first in 1998, the other being retained for trials and demonstration purposes. Long-range utility version for logistic and tactical support role also under consideration by Italy and proposed unsuccessfully to US Marine Corps, with RAF Merlin HC. Mk 3 used for month-long demonstration tour of USA in May 2001. VIP version offered to Saudi Arabia in 1995, EH101 selected in 2001 by Portugal for SAR, combat ASW and fisheries protection and by Denmark for SAR/Utility tasks. Portuguese EH101s built at Vergiate; those for Denmark at Yeovil; first Danish (M-501) and Portuguese (19601) helicopters both flew on 12 December 2003. Total of eight had been delivered to Portugal by 3 February 2006, when EH101 officially commissioned into service with 751 Squadron at Montijo. Danish deliveries began on 10 January 2006, with total of eight accepted by late 2006, when it was revealed that final six likely to be diverted to RAF and replaced by later production examples. Most recent customer is Japan, which committed in June 2003 to initial quantity of 14 for naval air arm; to be assembled in Japan.

EH101 was offered to Australia for Air 9000 requirement in August 2003, but subsequently eliminated from contest in December on grounds of size. Other potential customers include Malaysia (utility/CSAR) and Poland (VIP).

Prototypes assigned a 3,750 hour flight development programme, but had flown 5,000 hours by mid-1999. Additional 5,600 hours flown by PP8 and PP9 from Brindisi (Italy) and, from September 1998, Aberdeen (Scotland) in trial between March 1996 and June 2000, to improve reliability and prove extended (2,000 hour) overhaul intervals.

COSTS: Royal Navy GBP1.5 billion (1991) for 44 Merlin; RAF GBP500 million for 22 Merlin HC. Mk 3s; Canada CAD4.4 billion (1992) for 50 CH-148/149, reduced to CAD579 million for 15 CH-149 (AW320). Production investment phase (design, tooling, maturity and



Portuguese AgustaWestland EH101

1040465

EH101 ORDERS
(at February 2007)

Country	Service	Quantity	Commitment	Mk/Version	First aircraft
Canada	Armed Forces	15	5 Jan 98	511 (SAR)	149901
Denmark	Air Force	14	7 Dec 01 ¹	512 (SAR/Utility)	M-501
Italy	Navy	8	Oct 95	110 (ASW/ASVW)	MM81480
	Navy	4	Oct 95	112 (AEW)	MM81488
	Navy	4	Oct 95	410 (Utility)	MM81492
	Navy	4	Jan 02	413 (Amphib Support)	
Japan	Tokyo Police	1	Nov 96	510 (SAR)	JA01MP
	Navy	14	Jun 03	KHI-01 (MCM/Support)	8651
Portugal	Air Force	6	30 Nov 01	514 (SAR)	19601
	Air Force	2	30 Nov 01	515 (Fisheries Protection)	
	Air Force	4	30 Nov 01	516 (CSAR)	
UK	Navy	44	9 Oct 91	111/HM. Mk 1	ZH821
	RAF	22	9 Mar 95	411/HC. Mk 3	ZJ117
USA	Marine Corps	23	28 Jan 05	US101/VXXVH-71A	

¹ Contract signature

product support) valued at GBP200 million (1993). First Italian batch (16) valued at Lit1,250 billion (USD775 million). 1995, of which Westland's share is GBP150 million. UK official audit of early 1996 reported Merlin HM. Mk 1 as GBP351 million (36.1 per cent) over budget and 60 months late. Danish order for 14 reportedly worth USD343.3 million. Development and procurement of VXX by US Navy expected to cost USD6.1 billion (2005).

DESIGN FEATURES: Three-engine power margin with long-endurance 120 kt (222 km/h; 138 mph) cruise possible on two engines and good twin-engined hover performance. Fail-safe/damage-tolerant airframe and rotating components, high system redundancy, onboard monitoring of engines/transmission/avionics/utility systems; airframe/power plant/rotor and transmission systems/flight controls/utility systems common to all variants; five-blade main rotor with multiple load path hub and elastomeric bearings; blades of advanced aerofoil section with BERP-derived high-speed tips; four-blade teetering tail rotor; transmission has minimum 30 minutes (60 minutes demonstrated) run-dry capacity; fuselage in four main modules (front and centre ones common to all variants, modified rear fuselage and slimmer tailboom on military utility variant to accommodate rear-loading ramp); automatic power folding of main rotor blades and tail rotor pylon on naval variant, with emergency manual back-up (tail section folds forward/downward, stowing starboard half of tailplane beneath rear fuselage). Folding version of utility (rear ramp) EH101 has been designed. New active vibration cancelling system ACSR (active control of structural response) reduces vibration by 80 per cent at blade passing frequency.

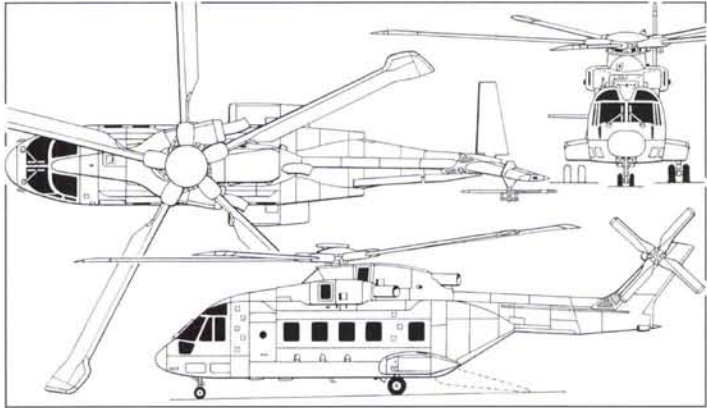
Airframe overhaul interval 1,000 hours on service entry; eventual target 3,000 hours. Intended service life of 40,000 hours.

FLYING CONTROLS: Conventional cyclic, collective and yaw pedals for pilot and co-pilot. Dual digital AFCS with four-axis autopilot incorporating coupled flight director, SAR and ASW modes.

STRUCTURE: Rotor head of composites surrounding a metal core; composites blades; fuselage mainly aluminium alloy, with bonded honeycomb main panels; composites for such complex shapes as forward fuselage, upper cowlings panels, tailfin, tailplane and windscreen. Engine air intakes of Kevlar reinforced with aero-web honeycomb. Tail unit of carbon epoxy and Kevlar epoxy skinned sandwich panels over central skeleton of metal- or foam-cored composites ribs and longerons; Kevlar-Nomex-Kevlar sandwich for leading-edge of tailfin. Single-sourced series production, with final assembly lines in Italy and UK. Composites materials to be replaced by aluminium on VH-71A in order to comply with US Navy crashworthiness requirements.

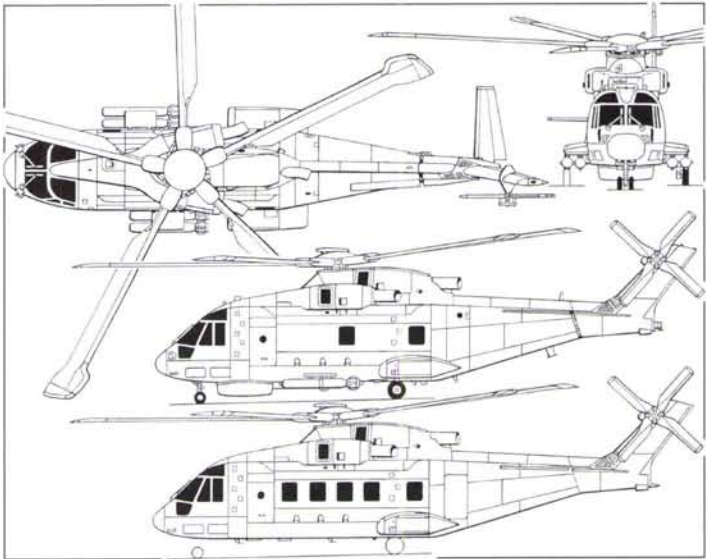
LANDING GEAR: Hydraulically retractable tricycle type, with single mainwheels and steerable twin-wheel nose unit, designed and manufactured by AP Precision Hydraulics in association with Officine Meccaniche Aeronautiche. Main units retract into fairings on sides of fuselage. Goodrich wheels, tyres and brakes; main units have size 8.50-10 wheels with 24x7.7 tyres, unladen pressure 6.96 bar (101 lb/sq in); nosewheels have size 19.5x6.75 tyres, unladen pressure 8.83 bar (128 lb/sq in). Twin-mainwheel gear optional for all variants; adopted for all Italian Navy helicopters and RAF Merlin. FPT Industries emergency flotation bags.

POWER PLANT: Three Rolls-Royce Turbomeca RTM 322-01/8 turboshafts in Royal Navy Merlin (maximum contingency rating 1,724 kW; 2,312 shp. T-O rating 1,566 kW; 2,100 shp and maximum continuous rating 1,394 kW; 1,870 shp); RTM 322-02/8 in RAF version, T-O rating 1,670 kW (2,240 shp); RTM 322 Mk 250 specified for Japanese helicopters; RTM 322-02/8 version of this engine chosen by Denmark and Portugal. General Electric T700-GE-T6A turboshafts in Italian naval variant, and T6A1 in Cormorant, rated at 1,521 kW (2,040 shp) for T-O and 1,327 kW (1,780 shp) maximum continuous. Engines for Italian naval variant assembled by Alfa Romeo Avio and Fiat; Cormorant engines assembled in Canada. Commercial and utility variants powered by three General Electric CT7-6 turboshafts (CT7-6A in PP3) with ratings of 1,491 kW (2,000 shp) for take-off and OEI and 1,282 kW (1,718 shp) maximum continuous; CT7-8E selected for VH-71A Increment 1 aircraft. Rolls-Royce Turbomeca RTM 322-04/8 turboshaft evaluated on RAF Merlin from latter half of 2004; additional power offers enhanced hot-and-high performance



Utility version of the EH101, showing modified rear fuselage with rear-loading ramp/door (Mike Keep)

0507157



Three-view of the naval EH101, with additional side view (bottom) of the Heliliner (Mike Keep)

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and increases MTOW to 15,600 kg (34,392 lb). Transmission rated at 4,161 kW (5,580 shp) for T-O, 3,715 kW (4,982 shp) maximum continuous and 2,769 kW (3,713 shp) OEI maximum continuous.

Standard fuel in three tanks, each of 1,074 litres (276 US gallons; 230 Imp gallons) capacity; total 3,222 litres (851 US gallons; 709 Imp gallons). Each tank feeds separate engine, except on selection of emergency cross-feed; self-sealing optional. Additional fourth or fifth tanks (all same size) optional; maximum fuel capacity 5,370 litres (1,417 US gallons; 1,181 Imp gallons). Merlin HC. Mk 3 capacity approximately 4,075 litres (1,077 US gallons; 896 Imp gallons), augmented by optional tank in cargo hold. Computerised fuel management system. Pressure refuelling point on starboard side; maximum transfer rate 682 litres (180 US gallons; 150 Imp gallons)/min; individual gravity refuelling positions on port side. Provision for detachable refuelling probe on RAF Merlins.

ACCOMMODATION: One or two pilots on flight deck (naval version capable of single-pilot operation, if required, and RN operates with pilot, observer and crewman; commercial variant certified for two-pilot operation). ASW version normally also carries observer and acoustic systems operator. Italian Navy ASW crew members are designated pilot/mission commander, co-pilot/tactical co-ordinator, and two sensor operators.

CH-149 Cormorant operates with pilot, co-pilot/navigator, flight engineer and two crewmen. Martin-Baker crew seats in naval version, able to withstand 10.7 m (35 ft)/s impact. Socea or Ipeco crew seats in commercial variant. Commercial version able to accommodate 30 passengers four-abreast at approximate seat pitch of 76 cm (30 in), plus cabin attendant, with lavatory, galley and baggage facilities (including overhead bins). Offshore variant offers 'club 4' grouped seating to facilitate rapid egress through windows in event of ditching. Military variant can accommodate up to 30 (seated) or 45 (non-seated) combat-equipped troops, 16 stretchers plus a medical team, palletised internal loads, or can carry externally slung loads of up to 5,443 kg (12,000 lb). SAR version can seat 28 survivors; or four seated patients, four stretchers and six medics; or 20 fully equipped Arctic rescuers with skis. It has also demonstrated an emergency evacuation capability with 55 in the cabin.

Main passenger door/emergency exit at front on port side with additional emergency exits on starboard side and on each side of cabin at rear, above main landing gear sponson. Large sliding door at mid-cabin position on starboard side, with inset emergency exit. Commercial variant has baggage bay aft of cabin, with external access via door on port side. Cargo loading ramp/door at rear of cabin on military and utility versions. Cabin floor loading 976 kg/m² (200 lb/sq ft) on PP1.

SYSTEMS: Hamilton Sundstrand/Microtecnica environmental control system, dual-redundant integrated hydraulic system, pressurised by three Vickers pumps each supplying fluid at 207 bar (3,000 lb/sq in) nominal working pressure, with flow rates of 55, 59 and 60 litres (14.5, 15.6 and 15.9 US gallons; 12.1, 13.0 and 13.2 Imp gallons)/min respectively. Hydraulic system reservoirs are of the piston load pressurised type, with a nominal pressure of 0.97 bar (14 lb/sq in).

Primary electrical system is 115/200 V three-phase AC, powered by two Lucas brushless, oil-spray-cooled 45 kVA generators (90 kVA if Lucas Spraymat blade ice protection system fitted), with one driven by main gearbox and the other by accessory gearbox, plus a third, separately driven standby alternator. Sundstrand T-62 APU for main engine air-starting, and to provide electrical power, plus air for ECS, without running main engines or using external power supplies. Lucas Spraymat electric de-icing of main/tail blades standard on naval variant, optional on others; in February 2003, Smiths Aerospace received contract to supply main and tail rotor blade ice protection system with effect from July 2003, this

incorporating electro-thermal heater mats on leading-edges of blades. Dunlop electric anti-icing of engine air intakes. Fire detection and suppression systems by Gravinier and Walter Kidde respectively.

AVIONICS (military): Integrated systems based on two MIL-STD-1553B multiplex databusses that link basic aircraft management, avionics and mission systems.

Comms: Royal Navy version has BAE Systems communications subsystem including internal voice intercommunication to six positions, plus secure voice transmission via two AD3400 V/UHF radios, UHF and HF, plus M/A-COM Ltd ARI 5983 I-band transponder and Link 11. Rascal RA 800 Light secure communications control system for RAF Merlin. Italian Navy equipment, by Elmer, includes three SRT-651 V/UHF, two SRT-170L HF, TD8503 Link 11, SP-1450 intercom and Italtel Mk 12 IFF; Mk 413 has Selex Communications satcom suite, UHF/VHF radios, and enhanced IFF. RAF Merlins have ADELTA (automatically deployed emergency loader transmitter) containing FDR and CVR and locator beacon, scabbled on to starboard rear fuselage. Telephonics Corporation SDI (secure digital intercommunications) system to be installed on EH101s for Denmark and Portugal. VH-71A configuration will include sophisticated communications suite.

Radar: ASW version fitted with 360° search radar (pulse-compressed, frequency-agile BAE Systems Blue Kestrel 5000 in UK's Merlin; Eliradar MM/APS-784 in Italian helicopters). AEW version has Eliradar HEW-784 coherent pulse Doppler, 360° scan radar. Italian Navy utility helicopters have second-hand (from Agusta-Bell 212ASW) Officine Galileo MM/APS-705B search and weather radar which is removable, if demanded by certain missions. Telephonics Corporation RDR-1600 SAR Weather Avoidance Radar system used by Danish EH101s. Portuguese EH101 fitted with Galileo APS-717 radar.

Flight: Smiths Industries OMI SEP 20 dual-redundant digital AFCS is standard, providing fail-operational autostabilisation and four-axis autopilot modes (auto hover, auto transitions to/from hover standard on naval variants, optional on commercial and military variants). AFCS sensors on naval variant include BAE Systems LINS 300 ring laser gyro inertial reference unit (IRU) and Litton Italia LISA-4000 strapdown AHRS; IRU also provides self-contained navigation, with Rascal Doppler 91E velocity sensor (Elmer system for Italy); Cossor Electronics GPS receiver selected for Royal Navy variant, Elmer GPS for Italian Navy aircraft. Other avionics on naval variants include Thomson-CSF AHV 16 radar altimeters (two) (Electronica J-band units for Italian Navy), BAE Systems low-air-speed sensing and air data system, and Alenia/BAE Systems aircraft management computer. DRS Technologies subcontracted by Smiths Industries to provide flight control computer systems for Danish EH101s and any future sales.

Instrumentation: Litton EFIS with six 160 × 160 mm (6 × 6 in) Smiths multifunction screens. In mid-2003, consideration reportedly being given to introduction of three 330 × 200 mm (13 × 8 in) screens, utilising split images to present information that is currently displayed on two or more MFDs.

Mission: On naval variant, main processing element of management system is a dual-redundant aircraft management computer which carries out navigation, control and display management, performance computation and health and usage monitoring of principal systems (engines, drive systems, avionics and utilities); it also controls basic bus. Alenia/Rascal cabin mission display unit. Surveillance radar (see above). Underwater detection in Royal Navy Merlin is by active/passive sonobuoys and Thales AQS-950 ADS (active dipping sonar) system, incorporating same company's AQS-903A acoustic processor for LOFAR, DIFAR, VLAD, Barra, DICAS and CAMBS buoys and Thomson Sintra folding lightweight acoustic system for helicopters (FLASH) expandable array, which has 750 m (2,460 ft) of cable and is manoeuvred by a high-speed winch. Merlin has Rascal Lightweight Common Control Unit as interface between crew and tactical navigation and communications systems. The HM. Mk 1 has four units (one each for pilot, co-pilot and two operators); HC. Mk 3 has one in the cabin primarily for maintenance management. Royal Navy Merlin also has Rascal Orange Reaper ESM, Normalair-Garrett mission recorder and sonobuoy/flare dispenser, Chelton sonobuoy homing system and Ultra processor for Link 11 datalink. The TMS 118 sonar was upgraded from 2001 with new, commercial, off-the-shelf processors, adding to speed and capacity. Honeywell HELRAS Mod 2 dipping sonar. Alenia AYK-204 processors (four) and Alenia SL/ALR-735 ESM in Italian ASW version, which also includes two operators' consoles with 350 mm (14 in) displays. ASST (anti-ship surveillance and tracking) version carries equipment for tactical surveillance and OTH (over the horizon) targeting, to locate and relay to a co-operating frigate the position of a target vessel, and for mid-course guidance of frigate's missiles. On missions involving patrol of an exclusive economic zone it can also, with suitable radar, monitor every hour all surface contacts within area of 77,700 km² (30,000 sq miles); can patrol an EEZ 400 × 200 n miles (740 × 370 km; 460 × 230 miles) twice in one sortie; and can effect boarding and inspection of surface vessels during fisheries protection and anti-smuggling missions. FLIR specified for all Italian Navy versions; BAE Systems MST-S FLIR turret, including magnifying mode, can be rapidly installed on RAF Merlins.

Self-Defence: RAF Merlins have integrated defensive aids including Raytheon laser detection, BAE Systems Sky Guardian 2000 RWR, Doppler-based MAWS, Northrop Grumman AN/AAQ-24 Nemesis DIRCM and BAE Systems North America AN/ALE-47 chaff/flare dispensers. Chaff and flare dispensers on all Italian versions, co-ordinated by Electronica ELT/156X(V2) RWR and BAE Systems RALM/I laser warner; Mk 413 has ELT/156X(V4) and RALM/I(V2) plus Selex/EADS AAR-60 MILDS II missile warning system and MES ECDS-2 chaff/flare dispensers.

AVIONICS (civil): Integrated avionics system of commercial variant based on ARINC 429 data transfer bus.

Comms: Rascal intercom system; Rockwell Collins or Honeywell communications system.

Radar: Honeywell weather radar.

Flight: BAE Systems Canada CMA-900 flight management system for fuel flow, fuel quantity and specific range computations; tuning of nav/com radios; interfaces with electronic instrument systems; two-dimensional multisensor navigation; and built-in navigational database with update service. AFCS sensors on commercial variant include two Litton Italia LISA-4000 strapdown AHRS. Standard avionics include Penny and Giles air data system.

Instrumentation: Smiths Industries/OMI electronic instrument system (EIS) providing colour flight instrument, navigation and power systems displays. CMA-900 includes colour CRT display with graphics and alphanumeric capability.

EQUIPMENT: ASW variants have two sonobuoy dispensers, external rescue hoist and Fairey Hydraulics (Merlin) decklock. BAJ Ltd four-float emergency flotation gear. Fast-roping equipment on Italian Navy Mk 413 amphibious support helicopter. AgustaWestland currently developing suite of equipment for AMCM (airborne mine countermeasures) mission; package will comprise operator's console; winch assembly; carriage, deployment and recovery system; and towed submersible unit. On-station duration, at 50 n miles (93 km; 58 mile) radius of action, will be 2.5 hours.

ARMAMENT (naval and military utility versions): Naval version able to carry up to four homing torpedoes (BAE Systems Sting Ray on Merlin; Mk 46 or Eurotorp MU90 on Italian version)

or other weapons, including Mk 11 Mod 3 depth charges. ASV version designed to carry two air-to-surface missiles (Marte Mk 2/S for Italian Navy) and other weapons, for use as appropriate, from strikes against major units using sea-skimming anti-ship missiles to small arms deterrence of smugglers. Armament optional on military utility versions: options include pintle-mounted machine guns in doorway/rear ramp, chin turret for 12.7 mm machine gun and stub-wings for rocket pods.

DIMENSIONS. EXTERNAL (A: naval variant, B: Heliliner, C: military/utility variant):

Main rotor diameter	18.59 m (61 ft 0 in)
Tail rotor diameter	4.01 m (13 ft 2 in)
Length:	
overall, both rotors turning	22.80 m (74 ft 9 3/4 in)
fuselage	19.53 m (64 ft 1 in)
main rotor and tail pylon folded:	
A	15.75 m (51 ft 8 in)
C	16.00 m (52 ft 6 in)
Width: cabin	2.80 m (9 ft 2 1/4 in)
fuselage overall (port sponson to starboard tailplane)	
A	5.09 m (16 ft 8 1/4 in)
C	4.61 m (15 ft 1 1/2 in)
over sponsons	
A	5.20 m (17 ft 0 3/4 in)
C	5.60 m (18 ft 4 1/2 in)
crew door open	5.32 m (17 ft 5 1/2 in)
Height: overall, both rotors turning	6.62 m (21 ft 8 3/4 in)
main rotor and tail pylon folded:	
A	5.20 m (17 ft 0 3/4 in)
C	5.30 m (17 ft 4 3/4 in)
Tailplane half-span	2.78 m (9 ft 1 1/2 in)
Wheel track	4.55 m (14 ft 1 1/4 in)
Wheelbase	6.98 m (22 ft 11 in)
Passenger door (fwd, port): Height	1.70 m (5 ft 7 in)
Width	0.91 m (3 ft 0 in)
Sliding cargo door (mid-cabin, stbd):	
Height	1.55 m (5 ft 1 in)
Width	1.83 m (6 ft 0 in)
Baggage compartment door (rear, port, B):	
Height	1.38 m (4 ft 6 in)
Width	0.55 m (1 ft 10 in)
Rear-loading ramp/door (rear, military/utility variant):	
Height	1.95 m (6 ft 4 3/4 in)
Width	2.26 m (7 ft 5 in)
Main rotor ground clearance (turning)	4.70 m (15 ft 5 in)

DIMENSIONS. INTERNAL:

Cabin:	
Length: A	7.09 m (23 ft 3 in)
C	6.50 m (21 ft 4 in)
Max width	2.49 m (8 ft 2 in)
Width at floor	2.26 m (7 ft 5 in)
Max height: B	1.90 m (6 ft 2 3/4 in)
Volume: A	29.0 m ³ (1,024 cu ft)
B	27.5 m ³ (970 cu ft)
Baggage compartment volume (B)	3.8 m ³ (135 cu ft)
Rear ramp (C): Length	2.10 m (6 ft 10 3/4 in)
Width	1.80 m (5 ft 10 3/4 in)

AREAS:

Main rotor disc	271.51 m ² (2,922.5 sq ft)
Tail rotor disc	12.65 m ² (136.2 sq ft)

WEIGHTS AND LOADINGS (A, B, C, as above):

Operating weight empty (estimated):	
A	10,500 kg (23,149 lb)
B (IFR, offshore equipped)	9,300 kg (20,503 lb)
C	9,350 kg (20,613 lb)
Merlin HC. Mk 3	10,250 kg (22,597 lb)
Max fuel weight (four internal tanks, total):	
A (JP-1)	3,406 kg (7,509 lb)
B, C (JP-4)	3,360 kg (7,408 lb)
Merlin HC. Mk 3	3,200 kg (7,055 lb)
Max fuel weight (five internal tanks, total):	
B, C (JP-4)	4,200 kg (9,259 lb)
Disposable load/payload:	
A (four torpedoes)	960 kg (2,116 lb)
B (30 passengers plus baggage)	2,850 kg (6,283 lb)
C (24 combat-equipped troops)	3,120 kg (6,878 lb)
Max underslung load	5,443 kg (12,000 lb)
Max T-O weight: A, B, C: normal	14,600 kg (32,188 lb)
overload	15,600 kg (34,392 lb)
Max normal disc loading: A, B, C	53.8 kg/m ² (11.01 lb/sq ft)
Transmission loading at normal max T-O weight and power	
A, B, C	3.51 kg/kW (5.76 lb/shp)

PERFORMANCE:

Never-exceed speed (VNE) at S/L, ISA	167 kt (309 km/h; 192 mph) IAS
Average cruising speed	150 kt (278 km/h; 173 mph)
Best range cruising speed	125 kt (232 km/h; 144 mph)
Best endurance speed	80 kt (148 km/h; 92 mph)
Service ceiling	4,575 m (15,000 ft)
Hovering ceiling: C: IGE	2,972 m (9,750 ft)
C: OGE	1,402 m (4,600 ft)
Range (B):	
four tanks, offshore IFR equipped, with reserves	610 n miles (1,129 km; 702 miles)
five tanks, offshore IFR equipped, with reserves	750 n miles (1,389 km; 863 miles)
Ferry range: C (four tanks plus internal auxiliary tank)	
1,130 n miles (2,093 km; 1,300 miles)	
SAR radius for 26 survivors, with two minute hover per survivor	350 n miles (648 km, 403 miles)
Endurance	5 h
g limit	+3

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Airbus Industrie set up 18 December 1970 as Groupement d'Intérêt Economique (GIE: a company which makes no profits or losses in its own right) and has been profitable since 1990, producing an operating surplus that is shared among its partners. Its first task was to manage development, manufacture, marketing and support of A300; this management subsequently extended to A300-600, A310, A318, A319/ACJ, A320, A321, A330, A340, A350 and A380. Sales reached the 1,000 mark in 1989; 2,000 in 1996; 3,000 in 1998; 4,000 in 2000; and 5,000 in August 2004. Turnover in 2005 was approximately EUR22.3 billion; backlog value EUR220.3 billion. Large Airliner Division created in March 1996 to oversee A3XX (later A380) project. Airbus delivered its 3,500th aircraft, an A318 for Air France, on 2 April 2004; the 2,500th member of the A320 family on 26 July 2005; and its 4,000th aircraft, an A330-300 for Lufthansa, on 9 September 2005. It is currently developing the A350 XWB, as a competitor to the Boeing 787. Offers business jet versions of A318 and A320 as part of A319 ACJ family.

A new single-aisle internal flight deck door, complying with pre-existing and new FAA anti-intrusion regulations, received JAA design approval on 21 May 2002 and is in production; it was certified for the A330/A340 family on 26 June 2002, and subsequently for all Airbus aircraft. In March 2003, Airbus selected Thales as its preferred supplier of HUDs for its entire range of FBW airliners, expected to appear first in the A320 family.

Plans for establishment of a single corporate entity (SCE) overtaken and modified by formation of European Aeronautic, Defense and Space Company (EADS, which see). Planned restructuring of the consortium into Airbus Integrated Company (AIC) was revealed in March 2000 and approved by the EC in late 2000; official starting date was 1 January 2001, although completion of formalities was delayed. EADS held 80 per cent and BAE Systems 20 per cent of AIC, which was incorporated in France on 11 July 2001 as an SAS (Société par Actions Simplifiées) following a formal decision on 23 June 2000. In 2006, BAE Systems indicated its wish to dispose of its holding in Airbus SAS, beginning discussions in April and committing to this course on 7 June. Airbus valuation of BAE share revealed as EUR2.75 billion (USD3.5 billion) on 2 July 2006, subject to shareholders' approval. BAE stake acquired 13 October 2006, making EADS sole owner of Airbus SAS.

Airbus is responsible for all work by partner companies and has more than 61,000 employees in Europe (France 21,400, Germany 23,650, Spain 3,100 and UK 13,000), as well as workers at its US, Chinese and Japanese subsidiaries. Stork (formerly Fokker) is an associate in A300 and A310 and Belairbus (Belgian consortium) in A310, A320, A330 and



Final assembly of A380s at Toulouse 1158605

A340. Alenia manufactures front fuselage plug for A321. An engineering centre was established in Moscow in a joint venture (registered in December 2002) with the Kaskol group, which has shares in Sokol, Hydromash, Rostvertol and other Russian aerospace companies; this was opened, with a workforce of 25, in late March 2003, to develop and co-produce components for the A380 and other Airbus types; General Director is Vladimir Raschupkin. Subject to formal approval by the Chinese government, a final assembly line for the A320 family is to be set up in Tianjin under a framework agreement with AVIC signed on 26 October 2006; Chinese assembly is planned to begin in 2009.

Subsidiaries include Airbus North America, Airbus Finance Company (AFC), formed in 1994, Airbus Japan and Airbus China. Airbus's training centre in Toulouse, previously a subsidiary known as Aeroformation, and the main spares centre, Airbus Materiel Support, formerly Airspares Hamburg, are integrated within the consortium's Customer Services Directorate; a new, purpose-built mockup centre was added to the Toulouse facilities during 1999 and was fully operational by end 2000. In July 1996, Airbus Training and Support Centre in Beijing was opened, becoming operational in October 1997. A Training Centre was opened in Miami, Florida, in October 1999.

AIRBUS A300-600

TYPE: Wide-bodied airliner.
PROGRAMME:

DEVELOPMENT MILESTONES

A300B	
Launched	29 May 69
First flight (B1)	28 Oct 72
Certification	15 Mar 74
Entered service (B2) (Air France)	30 May 74
Subsequent versions	
A300-600	
Go-ahead	16 Dec 80
First flight	8 Jul 83
Certification	9 Mar 84
First delivery (Saudi Arabian Airlines)	26 Mar 84
A300-600R	
First flight	9 Dec 87
Certification	10 Mar 88
First delivery (American Airlines)	20 Apr 88
A300-600F	
First flight	2 Dec 93
Certification	27 Apr 94
First delivery (Federal Express)	27 Apr 94

Launched 29 May 1969; initial variants were A300B1 (first flight 28 October 1972, service entry November 1974, A300B2 (first flight June 1973, service entry 30 May 1974) and A300B4 (first flight December 1974, service entry June 1975; 248 built. A300-600 go-ahead 16 December 1980; first flight (F-WZLR) 8 July 1983; certified (with JT9D-7R4H1 engines) 9 March 1984; first delivery (to Saudia) 26 March 1984.

Improved version with CF6-80C2 engines and other changes (see Current Versions) made first flight 20 March 1985; French certification for Cat. IIIB take-offs and landings 26 March 1985; first delivery of improved version (to Thai Airways) 26 September 1985. Extended-range A300-600R (then known as -600ER) made first flight 9 December 1987, receiving European and FAA certification 10 and 28 March 1988 respectively, deliveries (to American Airlines) beginning 20 April 1988; A300-600 powered by GE CF6-80C2A5 with FADEC granted 180-minute ETOPS April 1994. CIS certification granted May 1996. Bulk of production backlog are A300F4-600R Freighters for Federal Express and United Parcel Service. Final delivery is due to be made in July 2007.

CURRENT VERSIONS: **A300-600**: Advanced version of A300B4-200; major A300 version since early 1984. Passenger and freight capacity increased by fitting rear fuselage of A310 with pressure bulkhead moved aft; wings have simple Fowler flaps and increased trailing-edge

TOTALS OF AIRBUS AIRLINERS
(at 1 July 2006)

	A300	A310	A318	A319	A320	A321	A330	A340	A350	A380	Totals
Firm orders	561	260	90	1,400	2,591	651	595	386	100	159	6,793
Delivered	554	255	31	911	1,601	364	437	330	0	0	4,483
Operating	417	226	31	910	1,580	363	434	327	0	0	4,288

AIRBUS ORDERS and DELIVERIES 2005

Net orders	0	0	-7	19	40	26	3	3	33	0	117
Delivered	7	0	2	73	81	14	35	7	0	0	219
Backlog	8	5	60	392	918	190	154	69	100	159	2,055



Airbus A300-600 operated by Thai Airways International (Paul Jackson)

1158579

camber; forward-facing two-person flight deck with EFIS; new digital avionics; new braking control system; new APU; simplified systems; weight saving by use of composites for some secondary structural components; payload/range performance and fuel economy improved by comprehensive drag clean-up. Further improvements introduced in 1985 included CF6-80C2 or PW4000 as engine options, carbon brakes, wingtip fences and 'New World' flight deck; basic equipment of aircraft delivered from late 1991 further improved by incorporating standard options.

Cargo conversions of A300-600 and earlier A300B4 are offered; see *Jane's Aircraft Upgrades* for details.

Detailed description applies to current production A300-600/600R except where indicated.

A300-600R: Extended-range version of A300-600, differing mainly in having fuel trim tank in tailplane and higher maximum T-O weight.

A300-600 Convertible: Convertible passenger/cargo version, described separately.

A300-600 Freighter: Non-passenger version, described separately.

Airbus Super Transporter: A300-600R conversion as Super Guppy replacement.

AIRBUS A300 MARKS AND VARIANTS

Series	Mark	Power Plant	FAA Certification
B1	—	CF6-50A	not certified
B2	1A	CF6-50A	30 May 74
B2	1C	CF6-50C	19 Jun 75
B2K	3C	CF6-50C	30 Jun 76
B2	203	CF6-50C2	1 Oct 80
B4	2C	CF6-50C	30 Jun 76
B4	103	CF6-50C2	4 Oct 79
B4	203	CF6-50C2	2 Oct 81
B4	601	CF6-80C2A1	28 Mar 88
B4	603	CF6-80C2A3	19 Sep 88
B4	605R	CF6-80C2A5	28 Mar 88
B4	620	JT9D-7R4H1	19 Sep 88
B4	622R	PW4158	1 Aug 91
C4	605 (F)	CF6-80C2A5	21 Jun 02
F4	605R	CF6-80C2A5	27 Apr 94
F4	622R	PW4158	14 Jul 00

Series	Variant	MTOW (kg)
B2-1A	00	137,000
B2-1C	00	137,000
B2-1C	02	142,000
B2K-3C	00	142,000
B2-203	00	142,000
B4-2C	00	150,000
B4-2C	02,03,14	157,500
B4-103	00	150,000
B4-103	02,03,14	157,500
B4-203	00, 07	165,000
B4-601/03/20	00	165,000
B4-605R/22R	00	170,500
B4-605R/22R	01, 02	171,700
B4-605R/22R	03	167,800
C4-605R	00	170,500
F4-600R/22R	00	170,500
F4-600R/22R	06	165,100
F4-600R/22R	09	168,000

Notes: Variant parameters may include differences in data other than max T-O weight. Except as constrained by Series, Variants are applicable to several engine options

CUSTOMERS: Total of 561 of all A300 versions ordered, of which 554 delivered, by 1 November 2006. Outstanding contracts at 1 November 2006 comprised six Freighters for Federal Express and one for Sagawa Express.

AIRBUS A300 ORDERS
(at 1 November 2006)

Customer	Qty
Air Afrique	3
Air France	23
Air Hong Kong	8
Air India	3
Air Inter Europe	8
Alitalia	8
American Airlines	35
Amiri Flight	2
Ansett	8
Australian Airlines	5
China Airlines	15

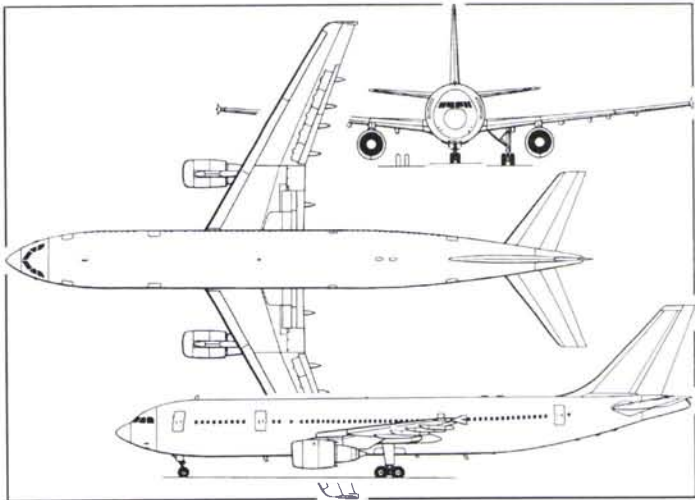
Customer	Qty
China Eastern Airlines	7
China Eastern Xibei	3
China Northern Airlines	6
CityBird	2
Continental Airlines	3
Cruzeiro	2
Eastern Airlines	34
Egyptair	17
Emirates	5
Federal Express	42
Finnair	2
Galaxy Airlines	1
Garuda	9
Hapag Lloyd	7
Iberia	6
Indian Airlines	10
ILFC	9
Iran Air	8
Japan Airlines	32
Japan Fleet Service	2
Korean Air	32
Kuwait Airways	8
Laker	3
LaTur	2
Lufthansa	23
Malaysia Airlines	4
Monarch	4
Olympic	10
Pakistan International Airlines	4
Pan Am	12
Philippine Airlines	5
Polaris Aircraft Leasing	5
Saudi Arabian Airlines	11
SAS	4
Singapore Airlines	8
SOGERMA SOCEA	1
South African Airways	7
Thai Airways	33
Trans European Airways	1
Tunis Air	1
United Parcel Service	53
Varig	2
VASP	3
Total	561

COSTS: USD109.9 million (2001).

DESIGN FEATURES: Mid-mounted wings with 10.5 per cent thickness/chord ratio, 28° sweepback at quarter-chord, and (since 1985) tip fences; circular-section pressurised fuselage; all-swept tail unit.

FLYING CONTROLS: Power-assisted. Each wing has three-segment, two-position (T-O/landing) leading-edge slats (no cutout over engine pylon), small Krueger flap at leading-edge wingroot, three cambered tabless flaps on trailing-edge, all-speed aileron between inboard flap and outer pair, and seven spoilers forward of flaps on each wing; flaps occupy 84 per cent of trailing-edge, increasing wing chord by 25 per cent when fully extended; ailerons deflect 9° 2' downward automatically when flaps are deployed; all 14 spoilers used as lift dumpers: outboard 10 for roll control and inboard 10 as airbrakes; variable incidence tailplane. Ailerons/elevators/rudder fully powered by hydraulic servos (three per surface), controlled mechanically; secondary surfaces (spoilers/flaps/slats) fully powered hydraulically with electrical control, tailplane by two independent hydraulic motors electrically controlled with additional mechanical input; preselection of spoiler/lift dump lever permits automatic extension of lift dumpers on touchdown; flaps and slats have similar drive mechanisms, each powered by twin motors driving ball screwjacks on each surface with built-in protection against asymmetric operation.

STRUCTURE: Two-spar main wing box, integral with fuselage and incorporating fail-safe principles; third spar across inboard sections; semi-monocoque fuselage (frames and open Z-section stringers), with integrally machined skin panels in high-stress areas; primary structure is of high-strength, damage-tolerant aluminium alloy, with steel or titanium for some critical fuselage components, honeycomb panels or selected glass fibre laminates for secondary structures; metal slats, flaps and ailerons. CFRP fins replaced aluminium alloy unit from 1988; secondary structure composites include AFRP for flap track fairings, rear wing/body fairings, cooling air inlet fairings and radome; GFRP for wing upper surface panels above mainwheel bays, fin leading/trailing-edges, fin/fuselage fairings, tailplane trailing-edges, elevator leading-edges, tailplane and elevator tips and elevator actuator access panel; carbon-reinforced GFRP for elevators and rudder; CFRP for spoilers, outer flap deflector doors and fin box; all CFRP moving surfaces have aluminium or titanium trailing-edges. Nosewheel doors and mainwheel leg fairing doors also of CFRP.



Airbus A300-600R wide-bodied transport (two GE CF6-80C2 turbofans) (Dennis Punnett) 1158560

Nose gear is structurally identical to that of B2/B4/A310; main gear is generally reinforced, with a new hinge arm and a new pitch damper hydraulic and electrical installation. Nacelles have CFRP cowlings panels and are subcontracted to Rohr (California); pylon fairings are of AFRP.

Airbus France builds nose (including flight deck), lower centre-fuselage, four inboard spoilers, wing/body fairings and engine pylons; Airbus Deutschland builds forward fuselage (flight deck to wing box), upper centre-fuselage, rear fuselage (including tailcone), vertical tail, 10 outboard spoilers and some cabin doors; it also equips wings and installs interiors and seats; Airbus UK (formerly BAE) designed wings and builds wing box; Airbus España manufactures horizontal tail, port and starboard forward passenger doors and mainwheel/nosewheel doors; Stork Aerospace produces wingtips, ailerons, flaps, slats and main gear leg fairings. Large, fully equipped and inspected airframe sections airlifted by Beluga to Airbus France at Toulouse for assembly and painting, aircraft then being flown to Hamburg for outfitting and returned to Toulouse for customer acceptance.

LANDING GEAR: Hydraulically retractable tricycle type, of Messier-Bugatti design, with Messier-Bugatti/Liebherr/Dowty shock-absorbers and wheels standard; twin-wheel nose unit retracts forward, main units inward into fuselage; free-fall extension; has four-wheel main bogies interchangeable left with right. Standard bogie size is 927 x 1,397 mm (36½ x 55 in); wider bogie of 978 x 1,524 mm (38½ x 60 in) is optional. Mainwheel tyres size 49x17-20 or 49x17.0R20 (30 ply) (standard) or 49x19-20 (30 ply) (wide bogie), with respective pressures of 12.41 and 11.10 bar (180 and 161 lb/sq in). Nosewheel tyres size 40x14 or 40x14.0R16 (22 ply), pressure 9.38 bar (136 lb/sq in). Steering angles 65°/95°. Messier-Bugatti/Liebherr/Dowty hydraulic disc brakes standard on all mainwheels. Normal braking powered by 'green' hydraulic system, controlled electrically through two master valves and monitored by a brake system control box to provide anti-skid protection. Standby braking (powered automatically by 'yellow' hydraulic system if normal 'green' system supply fails) controlled through a dual metering valve; anti-skid protection is ensured through same box as normal system, with emergency pressure supplied to brakes by accumulators charged from 'yellow' system. Automatic braking system optional. Bendix or Goodrich wheels and brakes available optionally. Minimum ground turning radius (effective, aft CG) 22.00 m (72 ft 2¼ in) about nosewheel, 34.75 m (114 ft 0 in) about wingtips.

POWER PLANT: Two turbofans in underwing pods. A300-600 was launched with 249 kN (56,000 lb st) Pratt & Whitney JT9D-7R4H1 and currently available with 249 kN (56,000 lb st) Pratt & Whitney PW4156 or 262 kN (59,000 lb st) General Electric CF6-80C2A1. A300-600R is offered with 274 kN (61,500 lb st) CF6-80C2A5 or 258 kN (58,000 lb st) PW4158. CF6-80C2A5 and PW4158 also available as options on A300-600.

Fuel in two integral tanks in each wing, and fifth integral tank in wing centre-section, giving standard usable capacity of 62,000 litres (16,379 US gallons; 13,638 Imp gallons). Additional 6,150 litre (1,625 US gallon; 1,353 Imp gallon) fuel/trim tank in tailplane (-600R only) increases this total to 68,150 litres (18,004 US gallons; 14,991 Imp gallons). Optional extra fuel cell in aft cargo hold can increase total to 73,000 litres (19,285 US gallons; 16,058 Imp gallons) in -600R. Two standard refuelling points beneath starboard wing; similar pair optional under port wing.

ACCOMMODATION: Crew of two on flight deck, plus two observers' seats. Passenger seating in main cabin in six-, seven-, eight- or nine-abreast layout with two aisles; typical mixed class layout has 266 seats (26 first class and 240 economy), six/eight-abreast at 96/86 cm (40/32 in) seat pitch with two galleys and one lavatory forward, one galley and two lavatories at Door 2 position, and one galley and four lavatories at rear; typical economy class layout for 285 passengers eight-abreast at 86 cm (34 in) pitch. Maximum capacity (subject to certification) 361 passengers. Closed overhead baggage lockers on each side (total capacity 10.5 m³; 370 cu ft) and in double-sided central 'super-bin' installation (total capacity 14.5 m³; 512 cu ft), giving 0.03 to 0.09 m³ (1.2 to 3.2 cu ft) per passenger in typical economy layout.

Two outward parallel-opening Type A plug-type passenger doors ahead of wing on each side, and one on each side at rear. Type I emergency exit on each side aft of wing. Underfloor baggage/cargo holds fore and aft of wings, with doors on starboard side: forward hold can accommodate 12 LD3 containers, or four 2.24 x 3.17 m (88 x 125 in) pallets or, optionally, 2.43 x 3.17 m (96 x 125 in) pallets, or engine modules; rear hold can accommodate 10 LD3 containers; additional bulk loading of freight provided for in an extreme rear compartment with usable volume of 17.3 m³ (611 cu ft); alternatively, rear hold can carry 11 LD3 containers, with bulk cargo capacity reduced to 9.0 m³ (318 cu ft); bulk cargo compartment can be used to transport livestock. Entire accommodation is pressurised, including freight, baggage and avionics compartments.

SYSTEMS: Air supply for air conditioning system taken from engine bleed and/or APU via two high-pressure points; conditioned air can also be supplied direct to cabin by two low-pressure ground connections; ram air inlet for fresh air ventilation when packs not in use. Pressure control system (maximum differential 0.574 bar; 8.32 lb/sq in) consists of two identical, independent, automatic systems (one active, one standby); automatic switchover from one to other after each flight and in case of active system failure; in each system, pressure controlled by two electric outflow valves, function depending on preprogrammed cabin pressure altitude and rate of change of cabin pressure, aircraft altitude, and preselected landing airfield elevation. Automatic prepressurisation of cabin before take-off, to prevent

noticeable pressure fluctuation during take-off. Modular box system provides passenger oxygen to all installation areas.

Hydraulic system comprises three fully independent circuits, operating simultaneously; each system includes reservoir of direct air/fluid contact type, pressurised at 3.52 bar (51 lb/sq in); fire-resistant phosphate ester-type fluid; nominal output flow 136 litres (35.9 US gallons; 30 Imp gallons)/min delivered at 207 bar (3,000 lb/sq in) pressure; 'blue' and 'yellow' systems have one pump each, 'green' system has two pumps. The three circuits provide triplex power for primary flying controls; if any circuit fails, full control of aircraft is retained without any necessity for action by crew. All three circuits supply ailerons, rudder and elevators; 'blue' circuit additionally supplies spoiler 7, spoiler/airbrake 4, airbrake 1, yaw damper and slats; 'green' circuit additionally supplies spoiler 6, flaps, Krueger flaps, slats, landing gear, wheel brakes, steering, tailplane trim, artificial feel, and roll/pitch/yaw autopilot; 'yellow' circuit additionally supplies spoiler 5, spoiler/airbrake 3, airbrake 2, flaps, wheel brakes, cargo doors, artificial feel, yaw damper, tailplane trim, and roll/pitch/yaw autopilot. Ram air turbine pump provides standby hydraulic power should both engines become inoperative.

Main electrical power supplied under normal flight conditions by two integrated drive generators, one on each engine; third (auxiliary) generator, driven by APU, can replace either of main generators, having same electromagnetic components but not constant-speed drive; each generator rated at 90 kVA, with overload ratings of 112.5 kVA for 5 minutes and 150 kVA for 5 seconds; APU generator driven at constant speed through gearbox. Three unregulated transformer-rectifier units (TRUs) supply 28 V DC power. Three 25 Ah Ni/Cd batteries used for emergency supply and APU starting; emergency electrical power taken from main aircraft batteries and emergency static inverter, providing single-phase 115 V 400 Hz output for flight instruments, navigation, communications and lighting when power not available from normal sources.

Hot air anti-icing of engines, engine air intakes, and outer segments of leading-edge slats; electrical heating for anti-icing flight deck front windscreens, demisting flight deck side windows, and for sensors, pitot probes and static ports, and waste water drain masts.

Honeywell 331-250F APU in tailcone, exhausting upward; installation incorporates APU noise attenuation. Self-contained fire protection system, and firewall panels protect main structure from an APU fire. APU provides bleed air to pneumatic system, and drives auxiliary AC generator during ground and in-flight operation; APU drives 90 kVA oil-spray-cooled generator, and supplies bleed air for main engine start or air conditioning system. For current deliveries of A300-600, APU has improved relight capability, and can be started throughout flight envelope.

For new A300-600s and -600Rs, two optional modifications offered for compliance with full extended-range twin-engine operations (ETOPS) requirements: hydraulically driven fourth generator and increased cargo hold fire suppression capability. ETOPS kit qualified for aircraft with CF6-80C2 and JT9D-7R series engines and, since mid-1988, for those with PW4000 series.

AVIONICS: *Comms:* Standard communications radios include two VHF, with provision for a third, two HF, two transponders, one Selcal, interphone and passenger address systems, ground crew call system and cockpit voice recorder. Provision for Mode S transponders.

Radar: Weather radar standard, with provision for second.

Flight: Radio navigation avionics include two VOR, two ILS, two DME, one ADF, two marker beacon receivers and two radio altimeters; TCAS and GPWS. Most other avionics are to customer requirements, only those relating to the instrument landing system (Honeywell or Rockwell Collins ILS and Rockwell Collins or TRT radio altimeter) being selected and supplied by the manufacturer. Two Honeywell digital air data computers standard; basic digital AFCS has dual flight control computers (FCCs) for flight director and autopilot functions (for Cat. III automatic landings), single thrust control computer (TCC) for speed and thrust control, and two flight augmentation computers (FACs) to provide yaw damping, electric pitch trim, and flight envelope monitoring and protection. Options include second FCC (for Cat. III automatic landings); second TCC; two flight management computers (FMCs) and two control display units for full flight management system. Basic aircraft also fitted with ARINC 717 data recording system with digital flight data acquisition unit, digital flight data recorder and three-axis linear accelerometer; optional additional level of windshield protection is available. Honeywell Enhanced GPWS available from March 1997.

Instrumentation: Six identical and interchangeable CRT electronic displays (four electronic flight instrument system and two electronic centralised aircraft monitor), plus digitised electromechanical instruments with liquid crystal displays.

DIMENSIONS, EXTERNAL:

Wing span	44.84 m (147 ft 1 in)
Wing chord at root	9.40 m (30 ft 10 in)
Wing aspect ratio	7.7
Length overall	54.08 m (177 ft 5 in)
Fuselage: Length	53.30 m (174 ft 10½ in)
Max diameter	5.64 m (18 ft 6 in)
Height overall	16.51 m (54 ft 2 in)
Tailplane span	16.26 m (53 ft 4 in)
Wheel track	9.60 m (31 ft 6 in)
Wheelbase (c/l of shock-absorbers)	18.62 m (61 ft 1 in)
Passenger doors (each): Height	1.93 m (6 ft 4 in)
Width	1.07 m (3 ft 6 in)
Height to sill: forward	4.60 m (15 ft 1 in)
centre	4.80 m (15 ft 9 in)
rear	5.50 m (18 ft 0½ in)
Emergency exits (each): Height	1.60 m (5 ft 3 in)
Width	0.61 m (2 ft 0 in)
Height to sill	4.87 m (15 ft 10 in)
Underfloor cargo door (forward):	
Height	1.71 m (5 ft 7¼ in)
Width	2.69 m (8 ft 10 in)
Height to sill	3.07 m (10 ft 1 in)
Underfloor cargo door (rear):	
Height	1.71 m (5 ft 7¼ in)
Width	1.81 m (5 ft 11¼ in)
Height to sill	3.41 m (11 ft 2¼ in)
Underfloor cargo door (extreme rear):	
Height (projected)	0.95 m (3 ft 1 in)
Width	0.95 m (3 ft 1 in)
Height to sill	3.56 m (11 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck: Length	40.70 m (133 ft 6¼ in)
Max width	5.28 m (17 ft 4 in)
Max height	2.54 m (8 ft 4 in)
Underfloor cargo hold:	
Length: forward	10.60 m (34 ft 9¼ in)

rear	7.95 m (26 ft 1 in)
extreme rear	3.40 m (11 ft 2 in)
Max height	1.76 m (5 ft 9 in)
Max width	4.20 m (13 ft 9 1/4 in)
Underfloor cargo hold volume:	
forward	75.1 m ³ (2,652 cu ft)
rear	55.0 m ³ (1,942 cu ft)
extreme rear	17.3 m ³ (611 cu ft)

AREAS:	
Wings, gross	260.00 m ² (2,798.6 sq ft)
All-speed ailerons (total)	7.06 m ² (75.99 sq ft)
Trailing-edge flaps (total)	47.30 m ² (509.13 sq ft)
Leading-edge slats (total)	30.30 m ² (326.15 sq ft)
Krueger flaps (total)	1.115 m ² (12.00 sq ft)
Spoilers (total)	5.40 m ² (58.13 sq ft)
Airbrakes (total)	12.59 m ² (135.52 sq ft)
Fin	45.20 m ² (486.53 sq ft)
Rudder	13.57 m ² (146.07 sq ft)
Tailplane	44.80 m ² (482.22 sq ft)
Elevators (total)	19.20 m ² (206.67 sq ft)

WEIGHTS AND LOADINGS (A: CF6-80C2A1/A5 engines, B: PW4156/4158 engines, both in 266-seat configuration)¹:

Manufacturer's weight empty:	
A (600)	79,210 kg (174,630 lb)
A (600R)	80,070 kg (176,525 lb)
B (600)	79,151 kg (174,500 lb)
B (600R)	79,320 kg (174,870 lb)
Operating weight empty:	
A (600)	90,115 kg (198,665 lb)
A (600R)	91,040 kg (200,700 lb)
B (600)	90,065 kg (198,565 lb)
B (600R)	90,965 kg (200,550 lb)
Max payload (structural): A (600)	39,885 kg (87,931 lb)
A (600R)	38,962 kg (85,896 lb)
B (600)	39,993 kg (88,169 lb)
B (600R)	39,037 kg (86,061 lb)
Max usable fuel:	
600: standard	49,786 kg (109,760 lb)
600R: standard	54,721 kg (120,640 lb)
with optional cargo hold tank	58,618 kg (129,230 lb)
Max T-O weight (A and B):	
600	165,000 kg (363,765 lb)
600R (basic)	170,500 kg (375,885 lb)
600R (option)	171,700 kg (378,530 lb)
Max ramp weight (A and B):	
600	165,900 kg (365,745 lb)
600R (basic)	171,400 kg (377,870 lb)
600R (option)	172,600 kg (380,520 lb)
Max landing weight (A and B):	
600	138,000 kg (304,240 lb)
600R (basic)	140,000 kg (308,645 lb)
Max zero-fuel weight (A and B):	
600, 600R (basic)	130,000 kg (286,600 lb)
Max wing loading: 600	634.6 kg/m ² (129.98 lb/sq ft)
600R (basic)	655.8 kg/m ² (134.32 lb/sq ft)

¹ Production aircraft from late 1996 onward. See 1989–90 and previous editions for original versions; 1996–97 and six previous editions for intermediate versions

PERFORMANCE (A and B as for Weights and Loadings):	
Max operating speed (VMO) from S/L to FL267	335 kt (621 km/h; 386 mph) CAS
Max operating Mach No. (MMO) above FL267	0.82
Max cruising speed:	
at FL250	480 kt (890 km/h; 553 mph)
at FL300	M0.82 (484 kt; 897 km/h; 557 mph)
Typical long-range cruising speed at FL310	M0.80 (472 kt; 875 km/h; 543 mph)
Approach speed: 600	135 kt (249 km/h; 155 mph)
600R	136 kt (251 km/h; 156 mph)
Max operating altitude	12,200 m (40,000 ft)
Runway ACN for flexible runway, category B:	
standard bogie and tyres: 600	56
600R	59
600R (option)	60
optional bogie and tyres: 600	52
600R	55
600R (option)	56
T-O field length at S/L, ISA + 15°C:	
600: A	2,378 m (7,800 ft)
B	2,270 m (7,450 ft)
600R: A (C2A5 engines)	2,408 m (7,900 ft)
B (PW4158 engines)	2,362 m (7,750 ft)
Landing field length: 600	1,536 m (5,040 ft)
600R	1,555 m (5,100 ft)

Range (1996 and subsequent deliveries) at typical airline OWE with 266 passengers and baggage, reserves for 200 n miles (370 km; 230 miles):	
600, GE/PW engines	3,700 n miles (6,852 km; 4,257 miles)
600R, GE/PW engines, standard fuel	4,050 n miles (7,500 km; 4,660 miles)
600R, GE/PW engines, optional fuel	4,157 n miles (7,700 km; 4,784 miles)
OPERATIONAL NOISE LEVELS (A300-600R, ICAO Annex 16, Chapter 3):	
T-O: A	91.1 EPNdB (96.3 limit)
B	92.2 EPNdB (96.3 limit)
Sideline: A	98.6 EPNdB (99.9 limit)
B	97.7 EPNdB (99.9 limit)
Approach: A	99.8 EPNdB (103.3 limit)
B	101.7 EPNdB (103.3 limit)

AIRBUS A300-600 CONVERTIBLE and A300-600 FREIGHTER

TYPE: Twin-jet freighter.

PROGRAMME: Specialised versions of A300-600. First flight of A300-600F 2 December 1993; certified early April 1994, delivered to Federal Express 27 April and entered service in same month; A300-600F powered by GE CF6-80C2A5 with FADEC was first A300-600 version to operate with 180-minute ETOPS in May 1994.

CURRENT VERSIONS: **Convertible:** For all-passenger or all-cargo configuration. Typical options include accommodation (in mainly eight-abreast seating) for maximum 375 passengers (subject to certification) on the main deck; or up to twenty 2.24 × 3.17 m (88 × 125 in) pallets; or five 88 × 125 in plus nine 2.44 × 3.17 m (96 × 125 in) pallets. Three built by October 2004, including one each for Air France and Air Hong Kong.

Freighter: For freighting only; no passenger systems provided; various systems options give airlines ability to adapt basic aircraft to specific freight requirements: Airbus offers conversion with port-side forward freight door, or as new-production **A300F4-600R**, with payload capacity of 54,000 kg (119,050 lb). Freighter conversions, offered by Airbus UK and EADS EFW, are detailed in *Jane's Aircraft Upgrades*; over 65 under conversion or completed by June 2001; maiden flight 13 December 2001 (D-ASAE, c/n 477); certified by LBA and FAA eight days later.

General Freighter: Similar to A300-600F, but with side door and cargo loading system able to handle all sizes of freight from small packets to large containers. Launch customer Air Hong Kong, which announced order for six in January 2003 (two delivered by 1 October 2004), with further four on option.

CUSTOMERS: Federal Express became A300-600 Freighter launch customer July 1991 with order for 25 and commitments for 50 more, of which 11 confirmed as orders in September 1996; all now delivered; total subsequently increased to 42; UPS placed order on 9 September 1998 for 30 PW4158 powered A300F4-600R Freighters plus options on a further 15 (later confirmed and a further 15 firm orders, to total 60, of which 45 delivered and in operation by 1 October 2004); 30 more then on option. Deliveries began mid-2000; in 2005, UPS cancelled its option on final 30 and reduced 60 total to 53, following decision to order A380; deliveries due for completion in July 2007.

AIRBUS A300 CONVERTIBLE AND FREIGHTER ORDERS
(at 1 November 2006)

Customer	Version	Qty
Air Hong Kong	A300F4-600R	8
Federal Express	A300F4-605R	42
Galaxy	A300F4-600R	1
Korean Air	A300F4-203	2
Kuwait Airways	A300C4-620	3
Sagawa Express	A300-600F	1
United Parcel Service	A300F4-600R	53
Total		110

STRUCTURE: Generally similar to A300-600. Main differences are large port-side main deck cargo door, reinforced cabin floor, smoke detection system in main cabin; main deck cargo door is on opposite side to door of forward underfloor hold, allowing simultaneous loading or unloading at all positions.

POWER PLANT: Options as for A300-600R; first example was first Airbus aircraft powered by GE CF6-80C2A5 with FADEC.

DIMENSIONS, EXTERNAL As A300-600R, plus:

Main deck cargo door (fwd, port):

Height (projected)	2.57 m (8 ft 5 1/4 in)
Width	3.58 m (11 ft 9 in)
Height to sill	4.91 m (16 ft 1 in)

DIMENSIONS, INTERNAL:

Cabin main deck usable for cargo:

Length	33.45 m (109 ft 9 in)
Min height	2.01 m (6 ft 7 in)
Max height:	
ceiling trim panels in place	2.22 m (7 ft 3 1/2 in)
without ceiling trim panels	2.44 m (8 ft 0 in)
Volume	192.0–203.0 m ³ (6,780–7,169 cu ft)

WEIGHTS AND LOADINGS (basic Convertible, A: with CF6-80C2A5 engines, B: with PW4158 engines):

Manufacturer's weight empty:

A, passenger mode	82,555 kg (182,000 lb)
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United Parcel Service A300F4-600R taking off

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B, passenger mode	82,470 kg (181,815 lb)
A, freight mode	80,345 kg (177,130 lb)
B, freight mode	80,260 kg (176,945 lb)
Operating weight empty:	
A, passenger mode	93,550 kg (206,240 lb)
B, passenger mode	93,475 kg (206,075 lb)
A, freight mode	81,600 kg (179,895 lb)
B, freight mode	81,525 kg (179,730 lb)
Max payload (structural):	
A, passenger mode	36,448 kg (80,354 lb)
B, passenger mode	36,523 kg (80,519 lb)
A, freight mode	48,400 kg (106,705 lb)
B, freight mode	48,475 kg (106,870 lb)
Max T-O weight: A, B	170,500 kg (375,900 lb)
Max landing weight: A, B	140,000 kg (308,650 lb)
Max zero-fuel weight: A, B	130,000 kg (286,600 lb)
WEIGHTS AND LOADINGS (basic Freighter variant of -600R):	
Manufacturer's weight empty:	
A	78,335 kg (172,700 lb)
B	78,250 kg (172,510 lb)
Operating weight empty: A	79,050 kg (174,275 lb)
B	78,980 kg (174,120 lb)
Max payload (structural):	
A, range mode	50,950 kg (112,325 lb)
B, range mode	51,020 kg (112,480 lb)
A, payload mode	54,750 kg (120,705 lb)
B, payload mode	54,820 kg (120,855 lb)
Max T-O weight: A, B:	
range mode	170,500 kg (375,900 lb)
payload mode	165,100 kg (363,980 lb)
Max landing weight: A, B:	
range mode	140,000 kg (308,650 lb)
payload mode	140,600 kg (309,970 lb)
Max zero-fuel weight: A, B:	
range mode	130,000 kg (286,600 lb)
payload mode	133,800 kg (294,980 lb)
PERFORMANCE:	
Range with max (structural) payload, allowances for 30 min hold at 460 m (1,500 ft) and 200 n mile (370 km; 230 miles) diversion:	
A, B, range mode	2,650 n miles (4,908 km; 3,050 miles)
A, B, payload mode	1,900 n miles (3,519 km; 2,186 miles)

AIRBUS A320

TYPE: Twin-jet airliner,
PROGRAMME:

DEVELOPMENT MILESTONES

A320-100	
Launched	23 Mar 84
First flight	22 Feb 87
Certification	26 Feb 88
First delivery (Air France)	28 Mar 88
Subsequent versions	
A320-200	
Certification	8 Nov 88

Launched 23 March 1984; four aircraft development programme (first flight 22 February 1987 by F-WWAD); JAA (UK/French/German/Dutch) certification of A320-100 with CFM56-5 engines, for two-crew operation, awarded 26 February 1988; first deliveries (Air France and British Airways) 28 and 31 March 1988 respectively; JAA certification of A320-200 with CFM56-5s received 8 November 1988, followed by FAA type approval for both models 15 December 1988; certification with V2500 engines (first flown 28 July 1988) received 20 April (JAA) and 6 July 1989 (FAA), deliveries with this power plant (to Adria Airways) beginning 18 May 1989; FAA approved common type rating on A320 and A321 without further training in early 1994; 500th A320 delivered, 20 January 1995, to United Airlines; 1,000th member of family (an A319) and 1,001st (A320) for United Airlines) were delivered 15 April 1999. Chosen by Thales as platform for its competitor in the South Korean Air Force's E-X AEW&C requirement. In 2000, Airbus



Airbus A320 of Kuwaiti airline Jazeera Airways

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agreed to transfer A320 assembly from Toulouse to Hamburg, where A319 and A321 already produced, EASA approval for 180 minute ETOPS granted in April 2004, Tianjin, China, to become additional final assembly line in 2009.

Cabin innovations unveiled in 2004 included a prototype cinema-style fold-up seat for the A320 family, designed to allow passengers to stow baggage in the overhead bins without blocking the aisle. It was hoped to certify the new design by the end of that year. In September 2004, Airbus announced successful completion, aboard an A320, of the first in-flight trial of GSM mobile telephones aboard an airliner, linking them to ground-based networks via the Globalstar satcom network. It hoped to offer passengers this facility from 2006. An A320 delivered to China Eastern on 26 July 2005 was the 2,500th aircraft of A318/319/320/321 family produced; the 4,000th aircraft of that family was also ordered in 2005.

CURRENT VERSIONS: **A320-100:** Initial version (21 ordered). Superseded by A320-200. Max T-O weight 68,000 kg (149,940 lb); fuel capacity (usable) 24,090 litres (6,364 US gallons; 5,299 Imp gallons).

A320-200: Now called simply **A320**. Basic version from third quarter 1988; differs from initial A320-100 in having wingtip fences, wing centre-section fuel tank and higher maximum T-O weights.

Detailed description applies to A320-200.

A320 Prestige: Member of ACJ family; Prestige interior as described under Accommodation heading in description of A319.

A320 Enhanced: Upgraded version, for new production or retrofit; development proceeding in 2006. Airframe improvements include two designs of winglets, flight tested on company testbed F-WWBA and an aircraft provided by jetBlue Airways; redesigned upper wing/fuselage fairing and engine pylons; and more fuel-efficient variants of CFM56 and V2500 engines. Internal improvements to include lighter cabin liners and brighter lighting; a 10 per cent increase in overhead storage capacity; lower cabin noise; and enhanced avionics. Availability targeted for 2008, but winglet change currently in abeyance.

MPA 320: Proposed maritime patrol version as replacement for Dassault-Breguet Atlantic 1; see AMC entry.

A320 research: An A320 was used for riblet research 1989-91. In mid-1998 Airbus Industrie began testing an experimental laminar-flow fin on an A320; air is sucked through small holes in the leading edge to reduce drag and save fuel.

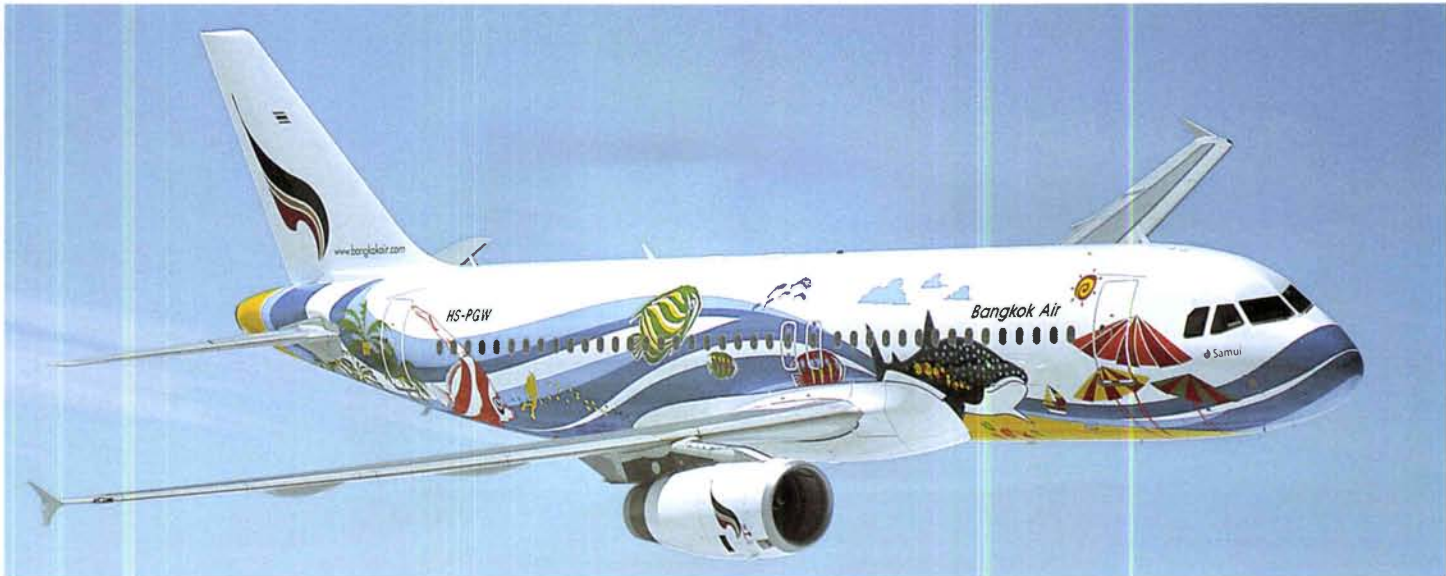
A320 Freighter, Convertible and Quick-Convertible: Freight variants under consideration; cargo capacities would be in the region of 20,000 kg (44,090 lb), 22,000 kg (48,500 lb) and 30,000 kg (66,140 lb), respectively. EADS EFW began feasibility studies in 2001 into producing freight versions of the A320 and A321. Early studies considered Hindustan Aeronautics as potential partner, but in mid-2006 EADS revealed details of a preliminary joint venture (50/50 shares) with Russian companies Irkut and RSK MiG. This proposes passenger-to-freighter (P2F) conversion of A320s, starting in about 2011, with work shared between EFW in Dresden and RSK MiG at Lkhovitsy. Freighter would be positioned in market as a cargo 'feeder' variant, with an expected payload capacity of some 21 to 23 tonnes.

NSR: In-house provisional designation (New Short Range) for eventual A320 successor. Studies under way in 2006.

A318: Shortened version of A320; described separately.

A319: Shortened version of A320; described separately.

A321: Stretched version of A320; described separately.



A highly decorated A320 of the Bangkok Airways fleet

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AIRBUS A320 MARKS AND VARIANTS			
Series	Mark	Power Plant	FAA Certification
100	111	CFM56-5A1	15 Dec 88
200	211	CFM56-5A1	15 Dec 88
200	212	CFM56-5A3	26 Nov 90
200	214	CFM56-5B4 or 5B4/P or 5B4/2P	12 Dec 96
200	231	V2500-A1	6 Jun 89
200	232	V2527-A5	12 Nov 93
200	233	V2527E-A5	17 Nov 95

Series	Variant	MTOW (kg)
100	000	68,000
200	000	73,500
200	001	68,000
200	003	75,500
200	007	77,000
200	008	73,500
200	009	75,500
200	010	77,000
200	011	75,500
200	012	77,000
200	013	71,500
200	014	73,500

Notes: Variant parameters may include differences in data other than max T-O weight. Except as constrained by Series, Variants are applicable to several engine options.

CUSTOMERS: Total 2,591 sold by 1 November 2006, of which 1,601 then delivered.

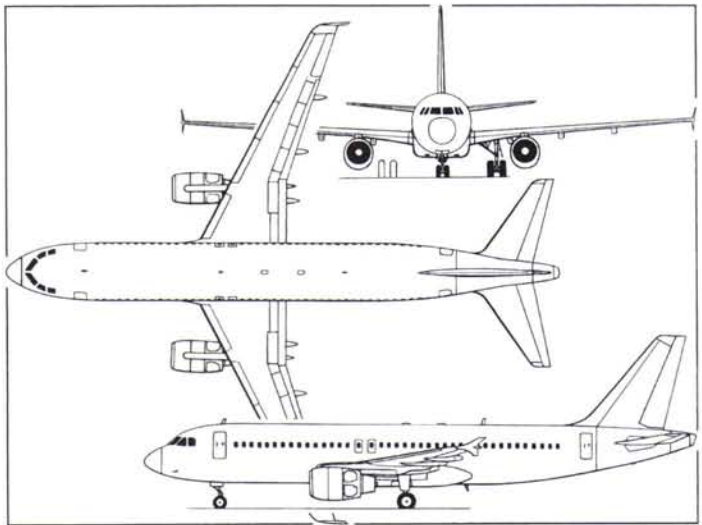
AIRBUS A320 ORDERS (at 1 November 2006)	
Customer	Qty
ACES	8
Adria Airways	5
Aegean Airlines	11
AERCAP	15
Aer Lingus	13
Aero Lloyd	4
Aeroflot	1
Aerostar	12
Aerventure	47
AirAsia	100
Air Berlin	45
Airblue	2
Air Cairo	4
Air Caledonie International	1
Air Canada	28
Air China Zhejiang Company	3
Air Deccan	62
Air France group	30
Air Inter Europe	22
Air Jamaica	4
Air Malta	2
Air New Zealand	5
Air One	30
Alafco	4
Alitalia	11
All Nippon Airways	31
Ansett Australia	19
Asiana Airlines	4
Austrian Airlines	8
Babcock and Brown	2
Blue Wings	16
Boullioun Aviation Services	24
British Airways	35
British Midland Airways	6
Canadian Airlines International	2
Cebu Air	2
China Aviation Supplies	90
China Eastern Airlines	34
China Eastern Xibei Airlines	13
China Southern Airlines	50
CIT Leasing	57
Condor Flugdienst	12
Croatia Airlines	2
Cyprus Airways	8
Czech Airlines	6
Dragonair	5
Edelweiss Air AG	3
Egyptair	12
Finnair	9
First Choice Airways	4
Flightlease	9
Frontier Airlines	10
GATX/CL AIR	37
GATX/Flightlease	2
GB Airways	8
GECAS	116
GPA	51
Gulf Air	14
Iberia	66
Iberworld	2
ILFC	201
Indian Airlines	35
IndiGo	70
Interjet	10

Customer	Qty
Jazeera Airways	10
jetBlue Airways	173
Kawasaki Leasing International	8
Kingfisher Airlines	32
Kuwait Airways	3
LAN Chile	18
Lotus Air	1
LTU	4
Lufthansa	47
Mexicana	16
Monarch Airlines	2
MyTravel Airways	6
NIKI	9
Northwest Airlines	80
Nouvelair	2
ORIX Corporation	24
Philippine Airlines	13
Qantas	20
Qatar Airways (incl Amiri Flight)	10
RBS Aerospace	33
Royal Jordanian	3
SALE	45
Sabena	3
Shenzhen Airlines	18
Shorouk Air	2
Sichuan Airlines	8
Silkair	10
South African Airways	22
Spanair	11
SriLankan Airlines	2
Sudan Airways	1
Swissair	17
Syrian Arab Airlines	6
TACA	43
TAM	44
TAP-Air Portugal	5
Tiger Airways	16
Thomas Cook	2
TransAsia Airways	5
Tunis Air	12
Turkish Airlines	19
United Airlines	117
US Airways	56
Virgin America	11
Wizz Air	32
Private customers	6
Undisclosed	10
Total	2,591

COSTS: Average cost of A320-200 USD53.7 million, depending on choice of engines, customisation and design weights (2001).

DESIGN FEATURES: First subsonic commercial aircraft to have composites for major primary structures, and centralised maintenance system; advanced-technology wings have 25° sweepback at quarter-chord, 5° 6' 36" dihedral plus experience from A310 and significant commonality with other Airbus aircraft where cost-effective; 6° tailplane dihedral.

FLYING CONTROLS: A320 is first subsonic commercial aircraft equipped for fly-by-wire (FBW) control throughout entire normal flight regime, and first to have sidestick controller (one for each pilot) instead of control column and aileron wheel. Thales/SFENA digital FBW system features five main computers and operates, via electrical signalling and hydraulic jacks, all primary and secondary flight controls; pilot's pitch and roll commands are applied through sidestick controller via two different types of computer; these have redundant architecture to provide safety levels at least as high as those of mechanical systems they replace; system incorporates flight envelope protection features to a degree that cannot be achieved with conventional mechanical control systems and its computers will not allow aircraft's structural and aerodynamic limitations to be exceeded; even if pilot holds sidestick fully forward, it is impossible to go beyond aircraft's maximum operating speed (VMO) for more than a few seconds; if pilot holds sidestick fully back, aircraft is controlled to an 'alpha floor' angle of attack, a safe airspeed above stall and throttles opened automatically to ensure positive climb. Nor is it possible to exceed g limits while manoeuvring. If a bank



Airbus A320 twin-turboprop single-aisle 150/179-seat airliner (Dennis Punnett)
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angle of more than 30° is commanded with the sidestick, the bank angle is automatically returned to 30° when pressure is released.

Fly-by-wire system controls ailerons, elevators, spoilers, flaps and leading-edge slats; rudder movement and tailplane trim connected to FBW system, but also signalled mechanically when used to provide final back-up pitch and yaw control, which suffices for basic instrument flying. Each wing has five-segment leading-edge slats (one inboard, four outboard of engine pylon), two-segment Fowler trailing-edge flaps, and five-segment spoilers forward of flaps; all 10 spoilers used as lift dumpers, inner six as airbrakes, outer eight and ailerons for roll control and outer four and ailerons for gust alleviation; slat and flap controls by Liebherr and Lucas.

STRUCTURE: Generally similar to A310, but with AFRP for fuselage belly fairing skins; GFRP for fin leading-edge and fin/fuselage fairing; CFRP for wing fixed leading/ trailing-edge bottom access panels and deflectors, trailing-edge flaps and flap track fairings, spoilers, ailerons, fin (except leading-edge), rudder, tailplane, elevators, nosewheel/mainwheel doors, and main gear leg fairing doors. A320 was first airliner to go into production with CFRP tailplane.

Airbus France builds entire front fuselage (forward of wing leading-edge), cabin rear doors, nosewheel doors, centre wing box and engine pylons, and is responsible for final assembly; centre and rear fuselage, tailcone, wing flaps, fin, rudder and commercial furnishing undertaken by Airbus Deutschland; Airbus UK builds main wings, including ailerons, spoilers and wingtips, and main landing gear leg fairings; Belgian consortium Belairbus produces leading-edge slats; Airbus España responsible for tailplane, elevators, mainwheel doors, and sheet metal work for parts of rear fuselage; Mitsubishi builds wingroot shroud box under Airbus UK subcontract; AVIC 1 of China provides wing components and signed an MoU in November 2000 to increase its participation, possibly leading to complete wing production by 2007; GKN Aerospace providing cargo door actuators from January 2002. Parts suppliers in Russia include Sokol (from December 2003) and Irkut (from 2006). Final assembly undertaken at Toulouse until 2000; now at Hamburg; to be joined by Tianjin from 2009.

LANDING GEAR: Hydraulically retractable tricycle type, with twin wheels and oleo-pneumatic shock-absorber on each unit (four-wheel main-gear bogies, for low-strength runways, optional); Dowty main units retract inward into wing/body fairing; steerable Messier-Bugatti nose unit retracts forward; nosewheel steering angle $\pm 75^\circ$ (effective turning angle $\pm 70^\circ$). Tyre size 46x16 or 46x17.0R20 (30 ply) on main gear and 30x8.8 or 30x8.8-R15 (16 ply) on nose gear; optional tyres for main gear are 49x17 or 49x17R20 or 49x19R20 or 46x16-20 or 49x19-20. Tyres for main-gear bogie option are 915x300R16 or 36x11 or 46x17.0R20. Carbon brakes standard. Minimum ground turning radius 13.80 m (45 ft 3/4 in) about nosewheels, 22.90 m (75 ft 1/2 in) about mainwheels. Minimum width of pavement for 180° turn 23.1 m (75 ft 9/2 in).

POWER PLANT: Two turbofans. Options comprise IAE V2500-A1, V2527-A5 or V2527E-A5, all 110.3 kN (24,800 lb st); CFM International CFM56-5A1 of 111.2 kN (25,000 lb st); CFM-56-5A3 of 117.9 kN (26,500 lb st); or CFM56-5B4, -5B4/P or -5B4/2P of 120.1 kN (27,000 lb st). Nacelles by Rohr Industries; thrust reversers by Hispano-Suiza (pivoting door type) for CFM56 engines, by IAE (cascade type) for V2500s. Dual-channel FADEC system standard on each engine.

Standard usable fuel capacity in wing and wing centre-section tanks is 23,860 litres (6,303 US gallons; 5,249 Imp gallons); further 82 litres (21.6 US gallons; 18.0 Imp gallons) unusable. One or two additional centreline tanks (ACTs), each holding 2,900 litres (766 US gallons; 638 Imp gallons); can be fitted in rear underfloor baggage/cargo hold.

ACCOMMODATION: Standard crew of two on flight deck, with one (optionally two) forward-facing folding seats for additional crew members; seats for four cabin attendants. Single-aisle main cabin has seating for up to 179 (FAR) or 180 (JAR) passengers, depending upon layout, with locations at front and rear of cabin for galley(s) and lavatory(ies). Multiple customer choice of four-, five- and six-abreast layouts and standard or double-width aisle. Typical two-class layout has 12 seats four-abreast at 91.5 cm (36 in) pitch in 'super first' and 138 six-abreast at 81 cm (32 in) pitch economy class; alternative 152 six-abreast seats (84 business + 68 economy) at 86 and 78 cm (34 and 31 in) pitch respectively; single-class economy layout could offer 164 seats at 81 cm (32 in) pitch, or up to 179 in high-density configuration. Compared with existing single-aisle aircraft, fuselage cross-section is significantly increased, permitting use of wider triple seats to provide higher standards of passenger comfort; five-abreast business class seating provides standard equal to that offered as first class on major competitive aircraft. In addition, wider aisle permits quicker turnarounds. Overhead stowage space superior to that available on existing aircraft of similar capacity, and provides ample carry-on baggage space; best use of underseat space for baggage is provided by improved seat design and optimised positioning of seat rails.

Passenger doors at front and rear of cabin on port side, forward one having optional integral airstairs; service door opposite each of these on starboard side. Two overwing emergency exits each side. Fuselage double-bubble cross-section provides increased baggage/cargo hold volume and working height, and ability to carry seven containers derived from standard interline LD3 type. As base is same as that of LD3, all existing wide-body aircraft and ground handling equipment can accept these containers without modification. Forward and rear underfloor baggage/cargo holds, plus overhead lockers; with 164 seats, overhead stowage space per seat is 0.06 m³ (2.0 cu ft). Mechanised cargo loading system will allow up to seven LD3-based containers to be carried in freight holds (three forward and four aft). Additional bulk cargo hold at rear, underfloor.

SYSTEMS: Liebherr/ABG-Semca air conditioning. Hamilton Sundstrand/Nord-Micro pressurisation. Honeywell 36-300 APU standard; Honeywell 131-9(A) or APIC APS 3200 available as standard options. All are interchangeable on A318/319/320/321 family. Primary electrical system powered by two Hamilton Sundstrand 90 kVA constant frequency generators, providing 115/200 V three-phase AC at 400 Hz; third generator of same type, directly driven at constant speed by APU, can be used during ground operations and, if required, during flight. Hydraulic system pressure 207 bar (3,000 lb/sq in).

AVIONICS: Flight: Fully equipped ARINC 700 digital avionics including advanced digital automatic flight control and flight management systems; AFCS integrates functions of SFENA autopilot and Honeywell FMS; Honeywell air data and inertial reference system.

Instrumentation: Each pilot has two Thales/VDO electronic flight instrumentation system (EFIS) displays (primary flight display and navigation display); PFD was first on an airliner to incorporate speed, altitude and heading. Between these two pairs of displays are two Thales/VDO electronic centralised aircraft monitor (ECAM) displays developed from those on A310 and A300-600; upper display incorporates engine performance and warning, lower display carries warning and system synoptic diagrams.

DIMENSIONS, EXTERNAL:

Wing span	34.09 m (111 ft 10 in)
Wing chord at root	6.10 m (20 ft 0 in)
Wing aspect ratio	9.5
Length overall	37.57 m (123 ft 3 in)
Fuselage: Max width	3.94 m (12 ft 11 in)
Max depth	4.14 m (13 ft 7 in)
Height overall	11.76 m (38 ft 7 in)
Tailplane span	12.45 m (40 ft 10 in)

Wheel track (c/l of shock-struts)	7.59 m (24 ft 11 in)
Wheelbase	12.65 m (41 ft 6 in)
Passenger doors (port, forward and rear), each:	
Height	1.85 m (6 ft 1 in)
Width	0.81 m (2 ft 8 in)
Height to sill	3.415 m (11 ft 2 1/2 in)
Service doors (stbd, forward and rear), each	as corresponding passenger doors
Overwing emergency exits (two port and two stbd), each:	
Height	1.02 m (3 ft 4 1/4 in)
Width	0.51 m (1 ft 8 in)
Underfloor baggage/cargo hold doors (stbd, forward and rear), each:	
Height	1.25 m (4 ft 1 1/4 in)
Width	1.82 m (5 ft 11 1/2 in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck: Length	27.50 m (90 ft 2 3/4 in)
Max width	3.68 m (12 ft 1 in)
Max height	2.16 m (7 ft 1 in)
Aisle width: standard	0.48 m (1 ft 7 in)
option 1	0.58 m (1 ft 11 in)
option 2	0.635 m (2 ft 1 in)
option 3	0.69 m (2 ft 3 in)
Underfloor baggage/cargo holds:	
Length: forward	4.85 m (15 ft 11 in)
rear	9.80 m (32 ft 2 in)
Max width	2.63 m (8 ft 7 1/2 in)
Max height	1.24 m (4 ft 1 in)
Volume: forward	13.30 m ³ (469 cu ft)
rear	24.15 m ³ (853 cu ft)

AREAS:

Wings, gross	122.40 m ² (1,317.5 sq ft)
Ailerons (total)	2.74 m ² (29.49 sq ft)
Trailing-edge flaps (total)	21.10 m ² (227.12 sq ft)
Leading-edge slats (total)	12.64 m ² (136.06 sq ft)
Spoilers (total)	8.64 m ² (93.00 sq ft)
Airbrakes (total)	2.35 m ² (25.30 sq ft)
Vertical tail surfaces (total)	21.50 m ² (231.4 sq ft)
Horizontal tail surfaces (total)	31.00 m ² (333.7 sq ft)

WEIGHTS AND LOADINGS (typical 150-passenger configuration. A: CFM56-5B4/P engines, B: V2527-A5s):

Operating weight empty: A	42,100 kg (92,815 lb) ¹
B	42,482 kg (93,657 lb)
Baggage capacity:	
forward hold	3,402 kg (7,500 lb)
rear hold	4,536 kg (10,000 lb)
bulk hold	1,497 kg (3,300 lb)
Max payload: A	18,633 kg (41,079 lb)
B	18,518 kg (40,825 lb)
Max fuel	19,159 kg (42,238 lb)
Max T-O weight: basic	73,500 kg (162,040 lb)
option 1	75,500 kg (166,445 lb)
option 2	77,000 kg (169,755 lb)
Max ramp weight: basic	73,900 kg (162,920 lb)
option 1	75,900 kg (167,330 lb)
option 2	77,400 kg (170,635 lb)
Max landing weight: basic	64,500 kg (142,195 lb)
options 1 and 2	66,000 kg (145,505 lb)
Max zero-fuel weight: basic	61,000 kg (134,480 lb)
options 1 and 2	62,500 kg (137,790 lb)
Max wing loading:	
basic	599.5 kg/m ² (122.79 lb/sq ft)
option 1	615.8 kg/m ² (126.13 lb/sq ft)
option 2	628.1 kg/m ² (128.64 lb/sq ft)
Max power loading (V2527 engines):	
basic	312 kg/kN (3.06 lb/lb st)
option 1	320 kg/kN (3.14 lb/lb st)
option 2	327 kg/kN (3.20 lb/lb st)

¹ Options raise OWE to a maximum of 43,000 kg (94,800 lb)

PERFORMANCE (engines A and B as for Weights and Loadings, C: CFM56-5A3/5B4, D: 77,000 kg; 169,755 lb max T-O weight):

Max operating Mach No. (MMO)	0.82
Optimum cruising speed	M0.78
Max operating speed	350 kt (648 km/h; 403 mph) IAS
Max rate of climb at S/L	152 m (500 ft)/min
Initial cruise altitude	11,280 m (37,000 ft)
Max certified altitude	12,130 m (39,800 ft)
Service ceiling, OEI	5,945 m (19,500 ft)
T-O distance at S/L, ISA + 15°C: A	1,960 m (6,430 ft)
B	1,950 m (6,400 ft)
C	2,180 m (7,155 ft)
D	2,250 m (7,385 ft)

Landing distance at max landing weight:

A, B, C, D	1,490 m (4,890 ft)
------------	--------------------

Runway ACN (flexible runway, category B):

twin-wheel, standard 45x16R20 tyres	41
four-wheel bogie option, 36x11-16 Type VII or 900x300-R16	22

Range with 150 passengers and baggage in two-class layout, FAR domestic reserves and 200 n mile (370 km; 230 mile) diversion:

basic: A	2,592 n miles (4,800 km; 2,982 miles)
B	2,596 n miles (4,807 km; 2,987 miles)
option 1: A	2,800 n miles (5,185 km; 3,222 miles)
B	2,871 n miles (5,317 km; 3,303 miles)
option 2:	
A, C	3,045 n miles (5,639 km; 3,504 miles)
B	3,065 n miles (5,676 km; 3,527 miles)

OPERATIONAL NOISE LEVELS (ICAO Annex 16, Chapter 3: A, B and C as for performance):

T-O: A	88.0 EPNdB (91.5 limit)
B	84.8 EPNdB (91.5 limit)
C	85.4 EPNdB (91.5 limit)
Sideline: A	94.4 EPNdB (96.8 limit)
B	92.8 EPNdB (96.8 limit)
C	93.8 EPNdB (96.8 limit)

Approach: A	96.4 EPNdB (100.5 limit)
B	95.9 EPNdB (100.5 limit)
C	96.0 EPNdB (100.5 limit)

AIRBUS A318

TYPE: Twin-jet airliner.
PROGRAMME:

DEVELOPMENT MILESTONES

A318	
Announced	7 Sep 98
Launched	26 Apr 99
First flight	15 Jan 02
Public debut	6 May 02
Certification	23 May 03
First delivery (Frontier Airlines)	22 Jul 03

Short-bodied version of A319 (itself a truncated A320). Formally announced at Farnborough Air Show, 7 September 1998, although known to be under consideration (as A319M5) since late 1997 when AVIC/A1A/STPL AE316/AE317 venture became uncertain. Smallest aircraft in Airbus family; programme launched 26 April 1999 with orders, commitments and options for 109 aircraft; launch customer Air France (via ILFC). Final assembly at Hamburg, resulting in some A319 production being moved to Toulouse. First metal cut November 2000; final assembly began 9 August 2001; three scheduled for completion in 2002.

Prototype (F-WW1A; 1,599th of A320 family) made maiden flight 15 January 2002, powered by PW6000 engines. Public debut at ILA, Berlin, 6 to 12 May 2002. Second prototype, F-WW1B, flew 3 June 2002; shown at Farnborough July 2002. Certification originally planned for October and service entry December 2002; however, delays in PW6000 programme caused revised schedule; as a result, F-WW1A re-engined with CFM56-5B/Ps, making maiden flight in this form on 29 August 2002 and receiving JAA certification 23 May 2003. FAA approval came in following month, preceding initial deliveries to Frontier Airlines (N801FR, 22 July) and Air France (F-GUGA, 9 October 2003). Second prototype allocated to development of the PW6000-powered version; maiden flight (PW6124As) 9 December 2005 and EASA certification later that month. Undergoing trials in mid-2006 to obtain steep approach (5.5°) approval for operation into airports such as London City Airport where surrounding obstacles or restrictive noise regulations apply.

CURRENT VERSIONS: A318-100: Basic version.

A318 Elite: Business jet; announced at NBAA Convention, Orlando, Florida, 9 November 2005; offered in partnership with cabin outfitter Lufthansa Technik; up to 14 and 18 passengers (Elite and Elite +, respectively); range 4,000 n miles (7,408 km; 4,603 miles). EASA certification 21 December 2005. Launch customer Comlux of Zurich, Switzerland, whose first aircraft (D-AUAA/HB-IPP) made maiden flight 10 October 2006; first delivery in initial quarter of 2007; five (plus five options) ordered by National Air Services in November 2005 for delivery to Jeddah, Saudi Arabia, from late 2006. Member of ACJ (Airbus Corporate Jet) family; see entry for A319.

AIRBUS A318 MARKS AND VARIANTS

Series	Mark	Power Plant	EASA Certification
100	111	CFM56-5B8/P	23 May 03
100	112	CFM56-5B9/P	23 May 03
100	121	PW6122A	21 Dec 05
100	122	PW6124A	21 Dec 05

Series	Variant	MTOW (kg)
100	000	59,000
100	001	61,500
100	002	63,000
100	003	64,500
100	004	66,000
100	005	68,000
100	006	56,000
100	007	61,000
100	008	64,000

Notes: Variant parameters may include differences in data other than max T-O weight. Except as constrained by Series, Variants are applicable to several engine options.

CUSTOMERS: International Lease Finance Corporation (ILFC) signed MoU for up to 30 aircraft on 17 November 1998, subject to launch of project, followed by firm order 30 April 1999. First conditional airline customer, TWA, signed LoI on 9 December 1998 for 50, confirming 25 by firm order 14 December 1999 but cancelled when TWA taken over by American Airlines; other early customers included Egyptair (three on 17 July 1999 — first firm airline order, followed by two further examples, but subsequently all cancelled). Total orders 90, of which 31 delivered, at 1 November 2006. Despite slow start, in 2004 Airbus was predicting long-term sales of 300 to 400 A318s.

AIRBUS A318 ORDERS
(at 1 November 2006)

Customer	Engines	Qty
Air France group	CFM	18
Comlux Aviation	CFM	3
Frontier Airlines	CFM	9
GECAS	CFM	12
JetAlliance		1
LAN Chile		20
National Air Services		2
Tarom	TBD	4
US Airways	PW	15
Private customers		6
Total		90

COSTS: Programme cost estimated as USD300 million. Unit price USD41.7 million (2001). DESIGN FEATURES: Shorter fuselage and taller fin than rest of A320 family, with which it has 95 per cent commonality, including A319 wing, pylon and interface. Laser welding (rather than riveting) used on lower fuselage to reduce costs and weight; first use of this technology on airliner. Common pilot type rating with A319, A320 and A321.

FLYING CONTROLS: As A320.
STRUCTURE: As A320, but fuselage 4½ frames (2.39 m; 7 ft 10 in) shorter than A319; 0.79 m (2 ft 7 in) removed forward and 1.60 m (5 ft 3 in) aft of wing. Redesigned cargo doors. Fin has tip extension. Assembled in Germany by Airbus Deutschland, and Tianjin from 2009. China will have share of production work to offset AE31X project cancellation.
LANDING GEAR: As A320. Minimum ground turning radius 11.30 m (37 ft 1 in) about nosewheels, 19.50 m (63 ft 11¾ in) about mainwheels.
POWER PLANT: Designed originally for two 98.3 kN (22,100 lb st) Pratt & Whitney PW6122A or 105.9 kN (23,800 lb st) PW6124A turbofans with clamshell-type thrust reversers; A318 is launch aircraft for PW6000 family. Alternative (and first in-service) power plant is 96.1 kN (21,600 lb st) CFM International CFM56-5B8/P or 103.6 kN (23,300 lb st) CFM International CFM56-5B9/P, officially announced 4 August 1999. Thrust reversing and deflection, fuel tank capacities and locations as A320.
ACCOMMODATION: Two flight crew plus three cabin crew. Typical passenger capacity eight first class and 99 second class with 96/81 cm (38/32 in) seat pitch, or 117 in single-class seating; high-density seating for 129 passengers; certified for up to 136. Front and rear passenger doors on port side; service door opposite each on starboard side. Overwing emergency exit each side. A318 will not carry containerised freight due to smaller baggage doors (of which size reduced to maintain same engine nacelle clearance for loading vehicles as A319).

SYSTEMS: Generally as A320; new-generation cabin intercom data system (CIDS). AVIONICS: Generally as A320, but with new LCD screens.
DIMENSIONS, EXTERNAL: As A320 except:
Length overall 31.45 m (103 ft 2 in)
Height overall 12.55 m (41 ft 2 in)
Wheelbase 10.25 m (33 ft 7½ in)
Baggage doors (each): Height 1.24 m (4 ft 1 in)
Width 1.28 m (4 ft 2½ in)
DIMENSIONS, INTERNAL: As A320 except:
Cabin: Length 21.38 m (70 ft 1¾ in)
Underfloor baggage/cargo holds:
Length: forward 2.57 m (8 ft 5in)
rear 6.07 m (19 ft 11 in)
Volume: forward 6.51 m³ (230 cu ft)
rear 14.70 m³ (519 cu ft)

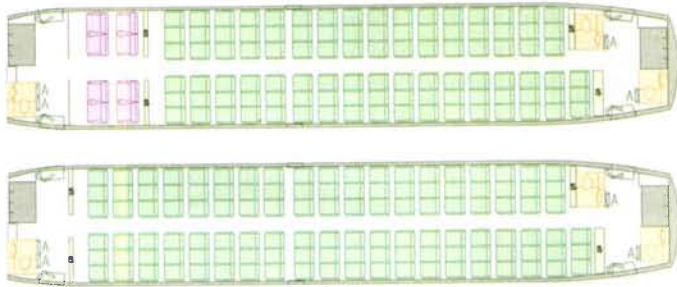
AREAS: As A320 except:
Fin and rudder (total, incl tab) 21.50 m² (231.4 sq ft)
WEIGHTS AND LOADINGS:
Typical operating weight empty 39,035 kg (86,057 lb)
Baggage capacity:
forward hold 1,614 kg (3,558 lb)
rear hold 2,131 kg (4,698 lb)
bulk hold 1,372 kg (3,025 lb)
Max payload 13,965 kg (30,788 lb)
Max T-O weight: basic 59,000 kg (130,075 lb)
option 68,000 kg (149,915 lb)
Max ramp weight: basic 59,400 kg (130,955 lb)
option 68,400 kg (150,800 lb)
Max landing weight: basic 56,000 kg (123,460 lb)
option 60,000 kg (132,275 lb)
Max zero-fuel weight: basic 53,000 kg (116,845 lb)
options 55,500 kg (122,355 lb)
Max wing loading: basic 481.2 kg/m² (98.57 lb/sq ft)
option 555.6 kg/m² (113.79 lb/sq ft)
Max power loading, CFM56-5B8/P engines:
basic 307 kg/kN (3.01 lb/lb st)
option 354 kg/kN (3.47 lb/lb st)

PERFORMANCE:
Max operating Mach No. (MMO) 0.82
Max operating speed 350 kt (648 km/h; 403 mph) IAS
Max certified altitude 12,200 m (40,000 ft)
Runway ACN: flexible Cat. B runway: basic MTOW 29
option 3 MTOW 34
T-O run at basic MTOW, 500 n mile (925 km; 575 mile) mission, elevation 610 m (2,000 ft), ISA +15°C:
PW6122 1,670 m (5,479 ft)
CFM56 1,630 m (5,348 ft)
Landing run at MLW, S/L, ISA:
PW6122 1,332 m (4,370 ft)
CFM56 1,355 m (4,446 ft)

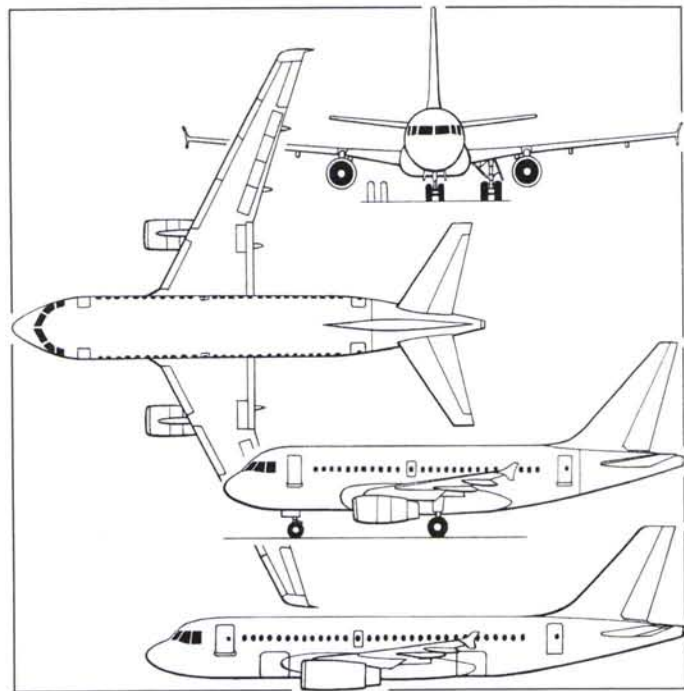


An Air France A318 shows off its planform

1158603



Airbus A318 representative cabin layouts for 107 seats (top) and 117 seats (bottom). A: attendant's seat, S: screen 0044887



General arrangement of the Airbus A318 with additional side view (lower) of A319 (James Goulding) 1158562

Range with 107 passengers, FAR domestic reserves, 200 n miles (370 km; 230 miles) diversion, max payload:	
basic MTOW:	
PW6122	1,462 n miles (2,707 km; 1,682 miles)
CFM56	1,455 n miles (2,694 km; 1,674 miles)
option 1 MTOW:	
PW6122	1,960 n miles (3,630 km; 2,255 miles)
CFM56	1,980 n miles (3,667 km; 2,278 miles)
option 2 MTOW:	
PW6122	2,820 n miles (5,222 km; 3,245 miles)
CFM56	2,880 n miles (5,333 km; 3,314 miles)
option 3 MTOW	
	3,250 n miles (6,019 km; 3,740 miles)
OPERATIONAL NOISE LEVELS (estimated):	
T-O with PW6122 at MTOW	79.7 EPNdB
Sideline	90.4 EPNdB
Approach	89.7 EPNdB

AIRBUS A319

TYPE: Twin-jet airliner, PROGRAMME:

DEVELOPMENT MILESTONES

A319	
Launched	10 Jun 93
Rolled out	24 Aug 95
First flight	29 Aug 95
Certification	10 Apr 96
First delivery (ILFC)	25 Apr 96
Entered service (Swissair)	8 May 96
Subsequent versions	
ACJ	
Announced	15 Jun 97
First flight	12 Nov 98
First delivery (Al Kharafi)	8 Nov 99

Short-fuselage A320, Airbus Board officially authorised start of sales 22 May 1992; programme launched 10 June 1993. Final assembly of first aircraft (F-WWDB, the 546th of the A319/320/321 family) began 23 March 1995; rolled out at Hamburg 24 August; first flight (with CFM56-5A engines) on 29 August; second aircraft (F-WWAS, No. 572) flew (with CFM56-5A engines and commercial interior) 31 October 1995; 650 hour flight test programme resulted in initial certification (CFM56-5B) on 10 April 1996 (CFM56-5A and V2500-A5 followed); first delivery, HB-IPV to ILFC on 25 April 1996 and immediately to Swissair on 30 April, flying first service on 8 May; F-WWAS re-engined with IAE V2524 engines, first flight 22 May 1996 and certified on 18 December 1996; other 1996 first

receipts included Air Inter (F-GPMA 21 June); Lufthansa (D-AILA 19 July); and Air Canada (C-FYIY 12 December). JAA 120 minute ETOPS approval granted 14 February 1997 and extended to ACJ in December 2000; 180-minute ETOPS (all versions) granted by EASA April 2004. 1,000th member of A320 family (an A319 for Air France via ILFC) delivered 15 April 1999.

CURRENT VERSIONS: **A319-100:** Baseline version.

Description applies to A319-100.

ACJ: Airbus Corporate Jetliner. Announced at 1997 Paris Air Show. Standard aircraft will carry up to 40 passengers over a range of 6,300 n miles (11,667 km; 7,250 miles), cruising at 12,500 m (41,000 ft) at speeds of up to M0.82. Certified as a commercial airliner to Cat. IIIb landing criteria and 180-minute ETOPS, and will convert easily to airliner configuration. First customer, announced on 18 December 1997, is Mohamed Abdulmohsin Al Kharafi of Kuwait. First aircraft (G-OMAK, 913th of A320 family), type A319-132, first flew 12 November 1998 and delivered to Jet Aviation, Switzerland, for outfitting on 31 December 1998; customer receipt 30 October 1999, operated by Twinjet Aircraft for Al Kharafi. JAR certification (as amendment of A319 certificate) received August 1999. Demonstrator F-WWIC first flew (as D-AVYB) 28 May 1999 and to Toulouse for trials 31 May; is 910th of A320 family, but followed c/n 913; eventually sold to UAE Air Force.

Orders and commitments totalled more than 30 by mid-2002, of which 14 then delivered: see accompanying table for latest customer list. FAA (FAR Pt 121) certification for both scheduled service and private operation in USA received October 2002.

Set world record non-stop 15 hour 13 minute flight of 6,918 n miles (12,812 km; 7,961 miles) from Santiago to Le Bourget on 16 June 1999.

Airbus announced in 2000 that production of the ACJ would be restricted to four per year until 2003; this was increased to six, due to demand. Four companies approved for outfitting: Lufthansa Technik (LHT), Hamburg; Jet Aviation, Basle; Associated Air Center, Dallas; and EADS Sogerma, Toulouse.

ACJ 'family' now includes A318 Elite and A320 Prestige; sales totalled 65 in November 2006.

A319LR: Long-range variant of ACJ; launched February 2003, when offered with 48-seat all business class interior and 35,400 litre (9,352 US gallon; 7,787 Imp gallon) fuel capacity, giving range of 4,500 n miles (8,334 km; 5,178 miles). Second aircraft for Qatar Airways (two-class layout for 110 passengers) is to this standard; entered service August 2003. Three more ordered by 30 September 2003: two for PrivatAir via CIT (48-seat all business class cabin) and one undisclosed.

A319 Executive: Variant of ACJ; 44-seat interior; lacks ACJ's auxiliary fuel tanks; 3,400 n mile (6,296 km; 3,912 mile) range. Three ordered by 30 September 2003: two for PrivatAir via CIT and one for Blue Moon Aviation (US) via SALE.

AIRBUS A319 MARKS AND VARIANTS

Series	Mark	Power Plant	FAA Certification
100	111	CFM56-5B5 or -5B5/P	20 Jun 97
100	112	CFM56-5B6 or -5B6/P or -5B6/2P	30 Aug 96
100	113	CFM56-5A4	20 Jun 97
100	114	CFM56-5A5	20 Jun 97
100	115	CFM56-5B7 or -5B7/P	22 Oct 02
100	131	V2522-A5	20 Jun 97
100	132	V2524-A5	20 Jun 97
100	133	V2527M-A5	22 Oct 02

Series	Variant	MTOW (kg)
100	000	64,000
100	001	70,000
100	002	75,700

Notes: Variant parameters may include differences in data other than max T-O weight. Except as constrained by Series, Variants are applicable to several engine options.

CUSTOMERS: Total of 1,400 (including 47 ACJs) sold, of which 911 delivered, by 1 November 2006.

AIRBUS A319 AND ACJ ORDERS (at 1 November 2006)

Customer	Qty
AERCAP	7
Aero Services Executive	1 ¹
Aeroflot	4
Aerventure	23
Air Berlin	15
Air Canada	37
Air China	32 ¹
Air France group	19 ¹
Air Inter Europe	9
Air Mauritius	2
Al Kharafi Group	2 ¹
Alitalia	12
Austrian Airlines	7
Azerbaijan Hava Yollari	4 ¹
BH Airlines	2
Boullion Aviation Services	2
Brazilian Air Force	1 ¹
British Airways	33
Cebu Air	10
China Aviation Supplies	40
China Eastern Airlines	5
China Southern Airlines	16
CIT Leasing	32
Croatia Airlines	4
Cyprus Airways	2
Czech Airlines	6
DaimlerChrysler Aviation	1 ¹
Druk Air	2
easyJet	140
Eurofly	1 ¹



A319 in the livery of AtlasJet International, one of two operating on lease in 2006

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Customer	Qty
Finnair	5
French Air Force	2 ¹
Frontier Airlines	19
GATX/CL AIR	1
GECAS	69
Germanwings	23
Hainan Airlines	28
Hamburg International	14
Iberia	20
ILFC	158
Indian Airlines	19
Italian Air Force	4 ¹
JAT	8
JetAlliance	1
Kingfisher Airlines	1
LAN Chile	15
Lufthansa	25
NIKI	2
Northwest Airlines	82
Pharmair Corporation	1
Qatar Airways	3 ¹
RBS Aerospace	4
Royal Thai Air Force	1 ¹
SALE	8
Sabena	15
SAS	4
Shenzhen Airlines	3
Sichuan Airlines	8
Silkair	6
Skybus	65
South African Airways	11
Spirit Airlines	7
Swissair	6
TACA	15
TAM	15
TAP-Air Portugal	13
Tunis Air	4
United Airlines	78
US Airways	114
Venezuelan Air Force	1 ¹
Virgin America	8
Volaris	16
Wizz Air	4
Other executive and private customers	22
Undisclosed	1
Total	1,400

¹ Indicates (or includes) ACJ

COSTS: Total development cost estimated at USD275 million, entirely financed by Airbus Industrie. A319-100 cost approximately USD48.7 million depending on choice of engines and level of customisation (2001); ACJ cost USD36 million (2001), excluding outfitting of between USD4 million and USD10 million.

DESIGN FEATURES: Seven fuselage frames shorter than A320 (1.60 m; 5 ft 3 in forward of wing, 2.13 m; 7 ft 0 in aft); modified rear cargo hold; bulk hold door and forward overwing emergency exit deleted; derated engines; otherwise little changed. Seats 124 passengers in typical two-class layout, compared with 150 in A320 and 185 in A321; range of 3,550 n miles (6,574 km; 4,085 miles) said to be the longest in this category of airliner; common pilot type rating with A320 and A321.

FLYING CONTROLS: Same flight deck and flying control system as A320.

STRUCTURE: As A320. Assembled in Germany by Airbus Deutschland, alongside the stretched A321; partner workshouses rearranged to maintain overall balance between France and Germany.

LANDING GEAR: As A320, but 46x16 or 46x17.0R20 main tyre options only. Minimum ground turning radius 12.10 m (39 ft 8½ in) about nosewheels, 20.60 m (67 ft 7 in) about mainwheels.

POWER PLANT: Two turbofans. Options comprise CFM56-5B5, -5B5/P or -5A4, all 97.9 kN (22,000 lb st); IAE V2522-A5 of 102.5 kN (23,040 lb st); CFM56-5B6, -5B6/P or -5B6/2P or -5A5, all 104.5 kN (23,500 lb st); IAE V2524-A5 of 108.9 kN (24,480 lb st), IAE V2527M-AS of 110.3 kN (24,800 lb st); or CFM56-5B7 or -5B7/P of 120.1 kN (27,000 lb st).

Standard (three tanks) fuel as for A320: 23,860 litres (6,303 US gallons; 5,249 Imp gallons) usable. Up to six additional centreline tanks (ACT) for maximum (nine tanks) of 40,640 litres (10,737 US gallons; 8,939 Imp gallons).

ACCOMMODATION: Typically 124 passengers (eight in 'super first' class plus 116 economy); maximum 145 passengers in all-economy configuration. Built-in airstairs in ACJ.

'Prestige' cabin option for ACJ configures forward and centre sections with dining and work areas complete with tables, lounge and bar; aft cabin has private office area and enclosed bedroom. Amenities include 64 kbyte communications links, large-screen video displays, external video cameras for security and flight progress monitoring, and additional aft cabin soundproofing.

DIMENSIONS, EXTERNAL: As A320 except:

Length overall 33.83 m (111 ft 0 in)

Wheelbase 11.05 m (36 ft 3 in)

DIMENSIONS, INTERNAL: As A320 except:

Cabin length (excl flight deck) 23.77 m (77 ft 11¾ in)

Underfloor baggage/cargo holds:

Length: forward 3.35 m (11 ft 0 in)

rear 7.67 m (25 ft 2 in)

Volume: bulk total 27.64 m³ (976 cu ft)

WEIGHTS AND LOADINGS:

Typical operating weight empty:

standard 40,160 kg (88,537 lb)

option 41,203 kg (90,837 lb)

Baggage capacity: forward hold 2,268 kg (5,000 lb)

rear hold 3,020 kg (6,600 lb)

bulk hold 1,497 kg (3,300 lb)

Max payload 16,653 kg (36,714 lb)

Max ramp weight: basic 64,400 kg (141,975 lb)

option 75,900 kg (167,330 lb)

Max T-O weight: basic 64,000 kg (141,095 lb)

option 75,500 kg (166,450 lb)

Max landing weight: basic 61,000 kg (134,480 lb)

option 62,500 kg (137,790 lb)

Max zero-fuel weight: basic 57,000 kg (125,665 lb)

option 58,500 kg (128,970 lb)

Max wing loading:

basic 522.9 kg/m² (101.09 lb/sq ft)

option 616.8 kg/m² (126.34 lb/sq ft)

Max power loading: basic, CFM56-5B5 327 kg/kN (3.21 lb/lb st)

option, CFM56-5B7 314 kg/kN (3.08 lb/lb st)

PERFORMANCE (A: with CFM56-5A4, CFM56-5B5 or V2522-A5; B: with CFM56-5A5, CFM56-5B6 or V2524-A5):

Max operating Mach No. (MMO) 0.82

Max operating speed 350 kt (648 km/h; 403 mph) IAS

Typical operating Mach No. 0.78

Max rate of climb 152 m (500 ft)/min

Max certified altitude: A319 12,130 m (39,800 ft)

ACJ 12,500 m (41,000 ft)

Service ceiling, OEI 6,400 m (21,000 ft)

T-O distance, S/L ISA+15°C:

basic: A 1,720 m (5,643 ft)

option: B 2,640 m (8,661 ft)



Airbus A319 of US operator Volaris

1158610



Hamburg take-off for the Brazilian Air Force's A319 Airbus Corporate Jet

1158611

Landing distance, S/L ISA: A, B	1,430 m (4,692 ft)
Range on normal fuel tankage with 124 passengers and baggage, FAR domestic reserves and 200 n mile (370 km; 230 mile) diversion:	
A, at T-O weight 64,000 kg (141,095 lb)	1,813 n miles (3,357 km; 2,086 miles)
B, at T-O weight 75,500 kg (166,450 lb)	3,697 n miles (6,846 km; 4,254 miles)
OPERATIONAL NOISE LEVELS (A, B as above):	
T-O: A	82.5 EPNdB
B	82.4 EPNdB
Sideline: A	92.6 EPNdB
B	92.2 EPNdB
Approach: A	93.9 EPNdB
B	94.2 EPNdB

AIRBUS A321

TYPE: Twin-jet airliner,
PROGRAMME:

DEVELOPMENT MILESTONES

A321-100	
Announced	22 May 89
Launched	24 Nov 89
Rolled out	3 Mar 93
First flight	11 Mar 93
Certification	17 Dec 93
First delivery (Lufthansa)	27 Jan 94
Entered service (Lufthansa)	18 Mar 94
Subsequent versions	
A321-200	
Launched	12 Apr 95
First flight	12 Dec 96
First delivery (Monarch Airlines)	24 Apr 97

Stretched version of A320. Announced 22 May and launched 24 November 1989; four development aircraft; rolled out 3 March 1993, first flight with V2530 lead engine 11 March 1993 (F-WWIA), second aircraft with alternative CFM56-5B engine in May 1993; V2530-powered version received European JAA certification 17 December 1993; CFM56-5B2-powered version certified by JAA 15 February 1994; CFM56-5B1 certified by JAA 27 May 1994; first delivery (D-AIRA to Lufthansa) 27 January 1994; first service with Lufthansa 18 March 1994. A321 powered by CFM56-5Bs passed cold-weather trials in Kiruna, January 1994; first with alternative engine handed over to Alitalia 18 March 1994. JAA approval for Cat. III automatic landings achieved in December 1994. 120-minute ETOPS granted 29 May 1996 and upgraded to 180-minute approval in April 2004. The 100th A321 (Alitalia's I-BIXZ) flew 1 July 1998. A321 also recommended by Northrop Grumman as platform for Joint STARS, competing for NATO's Airborne Ground Surveillance requirement (later dropped) and by Raytheon for the Republic of Korea Air Force's E-X AEW&C competition.

CURRENT VERSIONS: **A321-100:** Initial version.

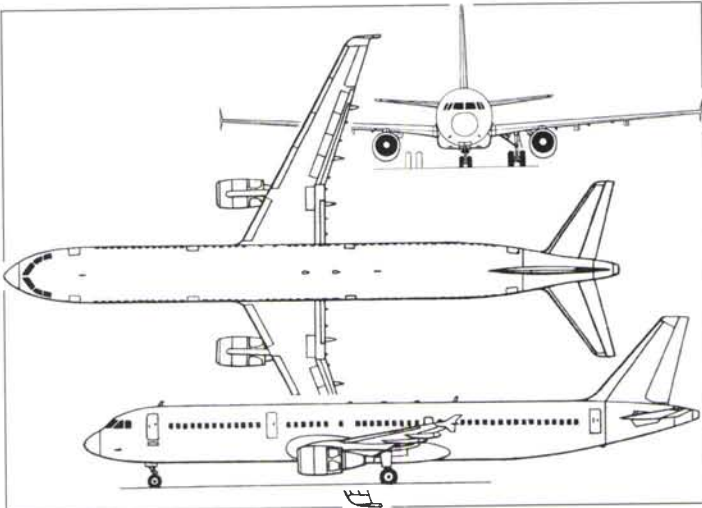
A321-200: Extended-range version, launched 12 April 1995; features reinforced structure, higher-thrust versions of existing engines and optional additional centre tank (ACT), capacity 2,900 litres (766 US gallons; 638 Imp gallons) which increases maximum T-O weight to 89,000 kg (196,210 lb) and range by 350 n miles (648 km; 402 miles). A321-200 expected to have increased market appeal on North American domestic routes; charter routes between northern and southern Europe; and on scheduled routes between Europe and Middle East. First aircraft flew 12 December 1996 at Hamburg; became G-OZBC of Monarch Airlines and delivered 24 April 1997. Higher-MTOW version, with option of second ACT, launched January 1999; first customer Spanair, delivery September 2000.

A321CJ: Airbus Industrie reported to be considering a corporate version with additional fuel tanks; no formal plans to launch announced by third quarter 2006.

A321 Freighter: EADS EFW conducting feasibility studies into an A321 Freighter with capacity for 14 standard pallets.

AIRBUS A321 MARKS AND VARIANTS

Series	Mark	Power Plant	FAA Certification
100	111	CFM56-5B1 or -5B1/P or -5B1/2P	20 Dec 95
100	112	CFM56-5B2 or -5B2/P	20 Dec 95
100	131	V2530-A5	20 Dec 95



A321 stretched development of the Airbus A320 (Dennis Punnett)

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Series	Mark	Power Plant	FAA Certification
200	211	CFM56-5B3/P or -5B3/2P	18 Sep 97
200	231	V2533-A5	18 Sep 97

Series	Variant	MTOW (kg)
100	000	83,000
100	002	83,000
100	003	85,000
200	000	89,000
200	000	93,000

Notes: Variant parameters may include differences in data other than max T-O weight. Except as constrained by Series, Variants are applicable to several engine options.

CUSTOMERS: Total of 651 sold, of which 364 delivered by 1 November 2006.

AIRBUS A321 ORDERS
(at 1 November 2006)

Customer	Qty
AERCAP	3
Aer Lingus	3
Aero Looyd	5
Aeroflot	10
Air Canada	10
Air China	24
Air France group	4
Air Inter Europe	7
Air Macau	1
Alitalia	23
All Nippon Airways	7
Asiana Airlines	8
Austrian Airlines	6
Blue Wings	4
Bmed	7
Boullioun Aviation Services	4
British Airways	16
British Midland Airways	6
China Aviation Supplies	50
China Eastern Airlines	15
China Northern Airlines	10
China Southern Airlines	25
CIT Leasing	8
Dragonair	2
Egyptair	4



Spanair Airbus A321

1133353

Customer	Qty
Finnair	4
Flightlease	1
GATX/CL AIR	7
GB Airways	7
GECAS	10
Iberia	19
ILFC	80
Indian Airlines	20
IndiGo	30
Kingfisher Airlines	4
Leisure International Airways	2
LTU	2
Lufthansa	41
Middle East Airlines	6
Monarch Airlines	7
MyTravel Airways	4
Onur Air	2
Qatar Airways	2
Royal Air Maroc	4
Sabena	3
SALE	5
SAS	8
Shanghai Airlines	5
Sichuan Airlines	6
Spanair	3
Spirit Airlines	7
Swissair	6
TACA	5
TAM	4
TAP-Air Portugal	3
TransAsia Airways	6
Turk Hava Yollari	12
US Airways	43
Vietnam Airlines	15
Undisclosed	6
Total	651

COSTS: A321-200 unit cost approximately USD65.6 million, depending on engine choice and customisation level (2001).

DESIGN FEATURES: Compared with A320, A321 has 4.27 m (14 ft 0 in) fuselage plug immediately forward of wing and 2.67 m (8 ft 9 in) plug immediately aft; pairs of wing fuel tanks unified and system simplified; other changes include local structural reinforcement of existing assemblies, slightly extended wing trailing-edge with double-slotted flaps, uprated landing gear and higher T-O weights.

STRUCTURE: As for A320 except for airframe changes noted under Design Features; front fuselage plug by Alenia and rear one by BAE Systems; final assembly and outfitting by Airbus Deutschland at Hamburg.

LANDING GEAR: Uprated, with 22 in wheel rims, 49x18.0-22 or 46x17.0R20 (30 ply) mainwheel tyres and increased energy brakes; wheels and brakes by Aircraft Braking Systems. Minimum ground turning radius 18.00 m (59 ft 0¾ in) about nosewheels, 27.60 m (90 ft 6½ in) about mainwheels.

POWER PLANT: Two turbofans. Options comprise: A321-100: IAE V2530-A5 of 133.0 kN (29,900 lb st); CFM56-5B1, -5B1/P or -5B1/2P of 133.4 kN (30,000 lb st); CFM56-5B2 or -5B2/P of 137.9 kN (31,000 lb st); and, for A321-200: IAE V2533-A5 of 140.6 kN (31,600 lb st); or CFM56-5B3/P or -5B3/2P of 142.3 kN (32,000 lb st).

Normal three-tank fuel capacity 23,700 litres (6,261 US gallons; 5,213 Imp gallons) usable. Fourth tank increases usable quantity to 26,600 litres (7,027 US gallons; 5,851 Imp gallons) in high pressure fuel system or 26,692 litres (7,051 US gallons 5,872 Imp gallons) in low pressure system. Fifth tank increases usable quantity to 29,684 litres (7,842 US gallons; 6,530 Imp gallons) low pressure (only).

ACCOMMODATION: Typically offers 24 per cent more seats and 40 per cent more hold volume than A320; examples are 185 passengers in two-class layout (16 'super first' class at 91 cm; 36 in seat pitch and 169 economy class at 81 cm; 32 in), or 220 passengers (certified limit) in all-economy high-density configuration. Each fuselage plug incorporates one pair of emergency exits, replacing single overwing pair of A320.

SYSTEMS: Choice of Honeywell 36-300 or APIC APS3200 APU; Honeywell 131-9(A) available from 1998; full commonality with A320 installation.

DIMENSIONS, EXTERNAL: As for A320 except:

Length overall	44.51 m (146 ft 0 in)
Height overall	11.81 m (38 ft 9 in)
Wheelbase	16.92 m (55 ft 6¼ in)

Emergency exits (forward stbd and rear port/stbd, each):

Height	1.52 m (5 ft 0 in)
Width	0.76 m (2 ft 6 in)

Emergency exit (forward port, usable also as passenger door):

Height	1.85 m (6 ft 1 in)
Width	0.76 m (2 ft 6 in)

DIMENSIONS, INTERNAL: As A320 except:

Cabin, excl flight deck: Length	34.44 m (113 ft 0 in)
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Underfloor baggage/cargo holds:

Length: forward	8.15 m (26 ft 9 in)
rear	11.40 m (37 ft 5 in)
Volume: forward	22.81 m ³ (806 cu ft)
rear	28.93 m ³ (1,022 cu ft)

WEIGHTS AND LOADINGS (A321-200):

Typical operating weight empty	49,200 kg (108,465 lb)
Max fuel weight: three tanks	18,960 kg (41,800 lb)
four tanks	21,280 kg (46,914 lb)
five tanks	23,746 kg (52,350 lb)
Max ramp weight: basic	83,400 kg (183,865 lb)
option	93,900 kg (207,015 lb)
Max T-O weight: basic	83,000 kg (182,985 lb)
option	93,500 kg (206,130 lb)
Max landing weight: basic	73,500 kg (162,035 lb)
option	77,800 kg (171,520 lb)
Max zero-fuel weight: basic	69,500 kg (153,220 lb)
option	73,800 kg (162,705 lb)
Max wing loading:	
basic	677.0 kg/m ² (138.66 lb/sq ft)

option	762.6 kg/m ² (156.20 lb/sq ft)
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Max power loading, CFM56-5B3:

basic	291 kg/kN (2.85 lb/lb st)
option	328 kg/kN (3.21 lb/lb st)

PERFORMANCE (A321-100, except where indicated; typical 185-passenger layout, C1: CFM56-5B1, V: V2530-A5, C2: CFM56-5B2, C3: CFM56-5B3, V2: V2533-A5):

Max operating Mach No. (MMO)	0.82
Max operating speed	350 kt (648 km/h; 403 mph) IAS
Typical operating Mach No.	0.78
Max rate of climb at S/L	152 m (500 ft)/min
Max certified altitude	12,130 m (39,800 ft)
Service ceiling, OEI: A321-100	5,180 m (17,000 ft)
A321-200	5,000 m (16,400 ft)

T-O distance at max T-O weight, S/L, ISA +15°C:

C1	2,220 m (7,285 ft)
V	2,065 m (6,775 ft)
C2	2,270 m (7,450 ft)
C3	2,330 m (7,645 ft)
V2	2,341 m (7,680 ft)

Landing distance at max landing weight:

C1, V	1,540 m (5,055 ft)
C2	1,530 m (5,020 ft)
C3, V2	1,577 m (5,175 ft)

Runway ACN (flexible runway, category B):

basic	48
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Range on normal fuel tankage with 185 passengers and baggage at typical airline OWE, FAR domestic reserves and 200 n mile (370 km; 230 mile) diversion: A321-100:

C1, C2:	
basic	2,138 n miles (3,959 km; 2,460 miles)
optional	2,250 n miles (4,167 km; 2,589 miles)
V: basic	2,253 n miles (4,172 km; 2,592 miles)
optional	2,386 n miles (4,418 km; 2,745 miles)

A321-200:

with one ACT	2,700 n miles (5,000 km; 3,107 miles)
with two ACT	3,000 n miles (5,556 km; 3,452 miles)

V2: basic

2,384 n miles (4,415 km; 2,743 miles)

with one ACT

2,714 n miles (5,026 km; 3,123 miles)

OPERATIONAL NOISE LEVELS (ICAO Annex 16, Chapter 3, estimated):

T-O: C1	87.0 EPNdB (92.1 limit)
V	85.4 EPNdB (92.1 limit)
Sideline: C1	96.2 EPNdB (97.2 limit)
V	94.5 EPNdB (97.2 limit)
Approach: C1	96.1 EPNdB (100.9 limit)
V	95.4 EPNdB (100.9 limit)

AIRBUS A340

TYPE: Wide-bodied airliner.
PROGRAMME:

DEVELOPMENT MILESTONES

A340-300	
Launched	5 Jun 87
First flight	25 Oct 91
Certification	22 Dec 92
First delivery (Air France)	26 Feb 93
Entered service (Air France)	29 Mar 93
Subsequent versions	
A340-200	
First flight	1 Apr 92
Certification	22 Dec 92
First delivery (Lufthansa)	29 Jan 93
Entered service (Lufthansa)	15 Mar 93
A340-600	
Launched	8 Dec 97
Rolled out	23 Mar 01
First flight	23 Apr 01
Public debut	16 Jun 01
Certification	29 May 02
First delivery (Virgin Atlantic)	22 Jul 02
Entered service (Virgin Atlantic)	1 Aug 02
A340-500	
Launched	17 Jun 97
Go-ahead	8 Dec 97
First flight	11 Feb 02
Certification	3 Dec 02
First delivery (Qatar Amiri Flight)	15 Sep 03

Launched 5 June 1987 as parallel programme with A330, uniquely offering twin- and four-engined variants of same basic design. First flight of four-engined A340-300 25 October 1991; A340-200 and -300 certified simultaneously by 18 European joint airworthiness authorities (JAA) on 22 December 1992; first deliveries to Lufthansa on 29 January 1993 (-200) and Air France on 26 February 1993 (-300); both versions entered service March 1993; both received FAA certification 27 May 1993. A340/A330 certified by JAA for GPS satellite navigation January 1994; successful trials conducted at Toulouse in October 1994 using differential global positioning (DGPS) for fully automatic landings, including roll-out. The 200th aircraft from A330/340 assembly line flew in November 1997; 100th A340 delivered to Singapore Airlines in February 1997; 180-minute ETOPS for Rolls-Royce Trent 700 engines awarded May 1996.

A340-500 and -600 were launched on 8 December 1997, at an estimated investment cost of USD2.9 billion. First flights took place on 11 February 2002 and 23 April 2001 respectively, followed by certifications on 3 December 2002 and 29 April 2002. A340-600 entered service with Virgin Atlantic 1 August 2002. 2,000th Airbus was A340-300 for Lufthansa, delivered 18 May 1999. 400th A330/A340 family member first flown 23 March 2001.

Cathay Pacific took delivery of an A340-300 covered with 700 m² (7,535 sq ft) of plastic film riblets in October 1996 in a trial intended to reduce fuel consumption (average ¾ tonne per medium- or long-range flight) by reducing drag (see illustrations in 1998-99 edition).



Airbus A340-500 of Etihad Airways

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CURRENT VERSIONS: **Initial A340-300:** Higher-capacity version, carrying up to 375 passengers (standard) or 440 (optional) and powered initially by CFM56-5C2 turbofans. Able to carry typical load of 295 passengers over distances of 7,300 n miles (13,519 km; 8,400 miles).

Current A340-300: (engineering designation -300X) powered by 151.2 kN (34,000 lb st) CFM56-5C4 turbofans; maximum T-O weight 271,000 kg (597,450 lb) with optional MTOW of 275,000 kg (606,275 lb); stronger landing gear, and aerodynamic and engine refinements, plus optional additional centre tank (ACT) for increased fuel capacity compared with basic A340-300. First flight (F-WWJH; CFM56-5C4 engines) 25 August 1995; first delivery, to Singapore Airlines, 17 April 1996.

A340-300E: Enhanced version with upgraded CFM56-5C4-P engines (trial engine first flew on an A340 on 19 November 2002); optional increased MTOW of 276,500 kg (609,575 lb); new style cabin from A340-600. Initial customer, South African Airways, ordered six in 2002; first delivery 9 March 2004.

A340-300 Awiator: Company testbed (MSN001/F-WWAS) for Aircraft Wing with Advanced Technology Operation (Awiator) R & D programme to explore ways of reducing aircraft wake, drag, noise and fuel consumption, and other technologies, which could be applied to future Airbus designs. Programme began in July 2002 and is testing such features as enlarged winglets, modified inboard spoilers/airbrakes, turbulence sensors and various vortex devices: as of mid-2006 was funded to extent of EUR80 million, of which half provided by European Union. Primary goals are to improve lift and reduce noise. First series of flight tests, in 2003, evaluated attachment of a small trailing edge device ('mini TED') in form of narrow, non-adjustable metal strip to an outboard landing flap; this followed in late 2005 and early 2006 by larger, movable, CFRP mini TEDs affixed to inboard flaps. Final phase, during second half of 2006, to flight test full set fitted to all flap trailing edges. After analysing test data, decision will be taken whether to apply this modification to production Airbus.

Initial A340-200: Short-fuselage, longer range version of A340-300, with same initial power plant; seating capacity 420 passengers, but more typically 303 in a two-class or 263 in three-class configuration; first flight (F-WWBA) 1 April 1992; entered service January 1993 with Lufthansa.

Current A340-200: Advanced version (previously referred to as A340-8000) with additional fuel in two tanks in rear cargo hold, strengthened fuselage and wings, CFM56-5C4 engines and 275,000 kg (606,275 lb) maximum T-O weight; first order placed March 1996 by Prince Jefri of Brunei for one VVIP aircraft, which first flew 19 December

1997 and was retained by Airbus during 1998; stored at Schönefeld-Berlin in 'green' condition, in 1999. Sold to Jordan for Royal Flight. New-build aircraft no longer marketed by Airbus.

A340-400: Series discontinued in favour of A340-600.

A340-500: Ultra-long range variant of A340-600 able to carry (typically) 313 passengers in three classes across 8,650 n miles (16,020 km; 9,954 miles). Fuselage 3.20 m (10 ft 6 in) longer than A340-300, representing 14 frame shrink of A340-600, plus additional fuel in rear centre tank. Launched at 1997 Paris Air Show and received go-ahead December 1997. Commonality with existing A330/A340 variants allows cross crewing and employment of common cargo containers and interiors to minimise training, staffing, provisioning and maintenance costs. Claims to be the world's longest-range airliner, justified twice in 2004 by Singapore Airlines with flights to Los Angeles and New York. Former, on 3 February, covered 7,609 n miles (14,093 km; 8,757 miles) in 14 hours 42 minutes; latter, distance 8,963 n miles (16,600 km; 10,314 miles), completed in 18 hours 18 minutes on 28 June. Development time of A340-500/600 series reduced by 25 per cent by use of Airbus Concurrent Engineering (ACE) shared CADD-CAD/CAM systems.

Compared with -300, has 0.53 m (1 ft 9 in) fuselage plug ahead of wings and 1.07 m (3 ft 6 in) plug to the rear; wings of increased chord (incorporating a third fuselage plug of 1.60 m; 5 ft 3 in) with span stretched to 63.45 m (208 ft 2 in); 31° 6' sweepback at quarter chord; taller vertical stabiliser is married to a new horizontal stabiliser to give increased chord fin with 0.50 m (1 ft 7 3/4 in) height extension. Max T-O weight 368,000 kg (811,300 lb). Landing gear adaptation involves replacement of central twin wheel unit with forward retracting brakeable double bogie unit. Rolls Royce Trent 553 of 236 kN (53,000 lb st) chosen as power plant; this combines fan diameter of Trent 700 with scaled IP and HP compressors and turbines of Trent 800, plus new high-lift LP turbine. Honeywell 331-600 APU chosen for A340-500/600 in March 1999. A340-500 initial launch commitments received from Air Canada, Emirates, SIA and ILFC. Maiden flight (F-WWTE, c/n 394) took place 11 February 2002; certified 3 December 2002. Higher gross weight version (380,000 kg; 837,755 lb) due for certification early 2007.

A340-600: Derivative of A340-300 with 20-frame fuselage stretch, 267 kN (60,000 lb st) class engines, increased horizontal tail area, full electrical control of rudder (replacing mechanical linkage between computer and actuator for both primary and secondary systems), additional fuel capacity, four-wheel central landing gear and 365,000 kg (804,690 lb) basic and 368,000 kg (811,300 lb) optional maximum T-O weights; can carry 380 three-class passengers or 475 in all-economy class up to 7,500 n miles (13,890 km;



B-6050, an Airbus A340-600 of China Eastern Airlines

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8,630 miles) and designed as Boeing 747 replacement with significantly lower costs and full commonality with A330/A340 family. Compared with A340-300, has same wing chord/fuselage centre-section, wing span, tailplane and fin modifications as -500, but with further 5.87 m (19 ft 3 in) plug ahead of wing and 3.20 m (10 ft 6 in) to the rear. Airbus and GE Aircraft Engines agreed in April 1996 that latter should be sole power plant source for -600, but this accord dissolved in February 1997 and Rolls-Royce Trent 556 of 249 kN (56,000 lb st) chosen on non-exclusive basis. Ram-air turbine fitted in underwing pod between engines on starboard wing. Launch commitments from Aerolineas Argentinas, Air Canada, Egyptair, Lufthansa, Swissair and Virgin Atlantic; initial firm order placed by Virgin on 15 December 1997 for eight, plus options. First metal cut 27 July 1998. Final assembly began June 2000; airframe completed September 2000 and engines fitted November 2000. Prototype (c/n 360) rolled out 23 March 2001 and first flew (F-WWCA) 23 April 2001; public debut at Paris Air Show, June 2001; second aircraft (c/n 371) handed to test department 8 June 2001 and first flown (F-WWCB) 18 June 2001; third test example, (c/n 376) flew 24 September 2001 (F-WWCC/G-VATL); three-aircraft 1,600 hour test programme completed. Programme of weight reduction and engine improvements implemented as a result of test data; weight optimisation to be achieved gradually by structural modifications; optimum configuration reached in 2003. Certification by JAA awarded 29 April 2002; first delivery (fourth aircraft, G-VSHY, to Virgin Atlantic) 22 July and entered service 1 August 2002. Higher gross weight (option 2) version launched at Paris Air Show, June 2003; expected to become standard version from mid-2006, following maiden flight 18 November 2005. Certified by EASA in April 2006; Qatar Airways is first customer, followed by Lufthansa, Virgin Atlantic and Etihad.

A340-600 Enhanced: Under study in 2005-06 as improved version incorporating some features of A350 (such as weight-saving materials and cabin changes), combined with RR Trent 1500 (1000/1700 family derivative) or GENx engines; objective increased range and reduced DOC. No further details available as at late 2006.

A340-600F: Development study for freighter version; considered by UPS for order eventually placed for MD-11 freighters; airline has option to convert some of its A300-600F orders to A340-600Fs if required.

AIRBUS A340 MARKS AND VARIANTS

Series	Mark	Power Plant	FAA Certification
200	211	CFM56-5C2 or -5C2/F or -5C2/G	27 May 93
200	212	CFM56-5C3/F or -5C3/G	7 Jul 94
200	213	CFM56-5C4	2 Oct 94
300	311	CFM56-5C2 or -5C2/F or -5C2/G	27 May 93
300	312	CFM56-5C3/F or -5C3/G	7 Jul 94
300	313	CFM56-5C4	2 Oct 97
500	541	Trent 553-61	27 Jan 03
600	642	Trent 556-61	22 Jul 02

Series	Variant	MTOW (kg)
200	000	253,500
200	001	257,000
300	000	253,500
300	001	257,000
500	000	368,000
500	001	372,000
600	000	365,000
600	001	368,000

Notes: Variant parameters may include differences in data other than max T-O weight. Except as constrained by Series, Variants are applicable to several engine options.

CUSTOMERS: Sales at 1 November 2006 totalled 385, of which 330 delivered. See table.

AIRBUS A340 ORDERS
(at 1 November 2006)

Customer	Version	Qty
Aerolineas Argentinas	600	6
Air Canada	300,500,600	13
Air China	300	3
Air China Southwest	300	3
Air France group	200, 300	14
Air Mauritius	300	5
Air Tahiti Nui	300	4
Austrian Airlines	200	4 ¹
Cathay Pacific	300	11
China Airlines (Taiwan)	300	6
China Eastern Airlines	300, 600	10
Egyptair	200	3



Lufthansa Airbus A340-600

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Customer	Version	Qty
Emirates	500, 600	28
Etihad	500, 600	8
Finnair	300	3
Flightlease	200/300	2
Gulf Air	300	6
Iberia	300, 600	29
ILFC	200/300, 600	28
Kuwait Airways	300	4
LAN Chile	300	6
Lufthansa	200/300, 600	52
Olympic Airways	300	4
Philippine Airlines	300	8
Qatar Airways	600	4
Sabena	200	5
SAS	300	7
Singapore Airlines	300, 500	22
South African Airways	300, 600	12
SriLankan Airlines	300	3
Swiss International Air Lines	300	9
TAP-Air Portugal	300	4
Thai Airways International	500, 600	10
Turk Hava Yollari	300	7
UTA	200/300	7
Virgin Atlantic Airways	300, 600	27
Private customers	200/300,500,600	7
Total		385

¹ Option to purchase two of these for French Air Force announced by DGA 22 September 2005

COSTS: Development cost of A340-500/-600 set at USD2.9 billion, 20 per cent lower than basic A340. Unit cost of A340-300 USD161.1 million; A340-500 USD177.8 million; A340-600 USD186.4 million (2002 prices).

DESIGN FEATURES: A340 capitalises on commonality with A330 (identical wing/cockpit/tail unit and same basic fuselage) to create aircraft for different markets, and also has much in common (for example, existing Airbus wide-body fuselage cross-sections, A310/A300-600 fin (except on -500/-600), advanced versions of A320 cockpit and systems) with rest of Airbus range; FAA has approved cross-crew qualification between A320 series, A330 and A340.

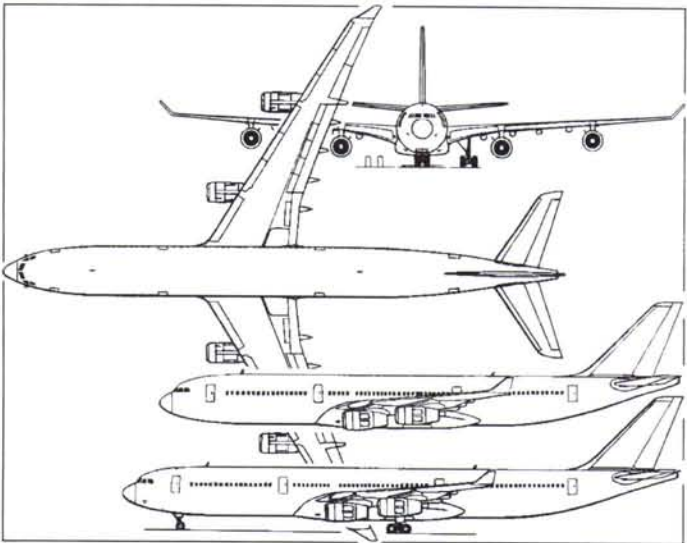
New design wing (by BAE Systems), approximately 40 per cent larger than that of A300-600, has 30° sweepback at quarter-chord and winglets raked at 29° 42'; thickness/chord ratios 15.25 per cent at root, 11.27 per cent at inner kink, 9.86 per cent at outer kink and 10.60 per cent at tip. A340-500/600 wing 20 per cent larger than basic A340, has increased sweepback of 30° 6' and 1.60 m (5 ft 3 in) (removable) extension to each wingtip, rake angle 31° 30'.

FLYING CONTROLS: In A330/A340 electronic flight control system (EFCS), roll axis is controlled by two individual outboard ailerons and five outboard spoiler panels on each wing; pitch axis control is by trimmable tailplane and separate left and right elevators; tailplane can also be mechanically controlled from flight deck, but fly-by-wire computer inputs are superimposed; single rudder is directly linked to rudder pedals, with dual yaw damping inputs superimposed. High-lift devices consist of full-span slats, flaps and aileron droop; speed braking and lift dumping by raising all six spoilers on each wing and raising all ailerons. Slats and flaps controlled outside main fly-by-wire complex by duplicated slat and flap control computers (SFCC).

Control surface maximum deflections (A340-500 and 600 in parentheses, where different): ailerons ±25° (inner +20°/-30°; outer ±25°); aileron droop 10°; elevator +15°/-30° (+17°/-30°); rudder ±31° 35' (±35°); flaps 32° (33° 40'); No 1, spoiler, speed brake 25°, lift dumper 25°; Nos. 2 and 3 spoilers, roll 35°, speed brake 30° (35°), lift dumper 50°; Nos. 4 and 5 spoilers (and No. 6), roll 35° (40°), speed brake 30° (40°), lift dumper 50°; slat No. 1 (21°); Nos. 2 to 7 slats 24°; stabilisers +2°/-14°.

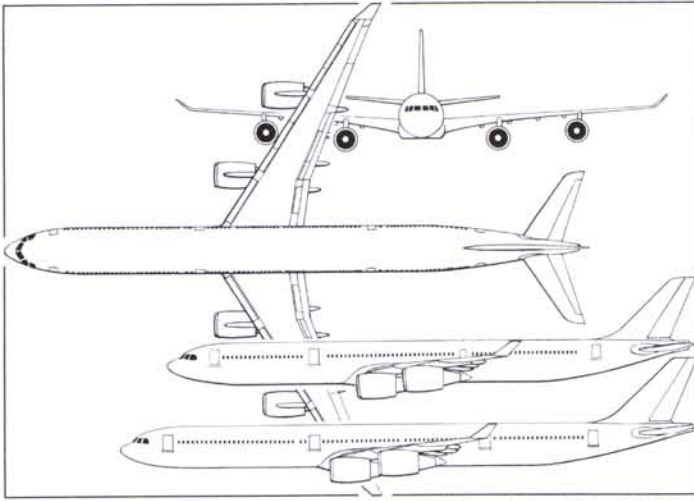
Control surface actuation by three hydraulic systems (green, yellow, blue); two powered control units (PCU) at each aileron and elevator are controlled either by primary or secondary flight control computers; single actuators at spoiler panels controlled by primary or secondary flight control computers; dual PCUs for fly-by-wire tailplane trimming, and for centrally located flap and slat actuators; three PCUs at rudder.

Fly-by-wire computers include three flight control primary computers (FCPC) and two flight control secondary computers (FCSC); each computer has two processors with different software; primary and secondary computers have different architecture and hardware; power supplies and signalling lanes are segregated; system provides stall



Airbus A340-300 four-turbofan long-range airliner, with additional side view (upper) of A340-200 (Dennis Punnett)

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Airbus A340-600 four-turbofan ultra-long-range airliner, with additional side view (upper) of A340-500 (James Goulding)

protection, overspeed protection and manoeuvre protection as in the A320, but the A330/340 computer arrangement maintains the protections for longer in the face of failures of sensors and inputs; FCPC and FCSC all operate continuously and provide comparator function to active channels, but only one in active control at any one control surface; reconfiguration logic can provide alternative control after failures; different normal and alternative control laws apply fly-by-wire basically as a demand in pitch and rate demand in roll, plus complex manoeuvre limitations; if all three inertial systems fail (removing attitude information), system reverts to direct mode in which control surface angle is directly related to sidestick position; ultimate control mode is direct control of rudder and tailplane angle from rudder pedals and manual trim wheel, which is sufficient for accurate basic instrument flight.

Pilots have sidestick controllers and normal rudder pedals; EFIS instrumentation consists of duplicated primary flight displays (PFD), navigation displays (ND) and electronic centralised aircraft monitors (ECAM); three display management computers, with separate EFIS and ECAM channels, can each control all six displays in their four possible formats; flight path control by duplicated flight management and guidance and envelope computers (FMGEC); they control every phase of flight including course, attitude, engine thrust and flight planning using information from GPS and inertial systems; point of no return calculations made automatically for long-range flights in A340/A330. Control system data are collected for maintenance purposes by two flight control data concentrator (FCDC) computers. Honeywell Pegasus flight management system evaluated 1999, before January 2000 certification.

In normal flight, bank angle limited to 33° hands-off (autopilot control) and 67° with full stick displacement; airspeeds limited to 305 kt (565 km/h; 350 mph) and M0.82 under automatic flight control; if stick is held fully forward, the nose is automatically raised when airspeed reaches VMO + 15 kt (28 km/h; 17 mph); if nose is raised, equivalent protections apply; 'alpha max' (13° clean and 19° with flap), slightly below maximum lift coefficient, is the greatest achievable with sidestick; 'alpha floor' is the angle of attack beyond which throttles progressively open to go-around power and airspeed is finally held steady just above stall, even if stick is continuously held back; alpha protection applied at 'normal' and 'hard' modes according to alpha rate; below protection speed (VPROT) of 142 kt (263 km/h; 163 mph) automatic and manual trimming stops; outer ailerons remain centred at over 200 kt (371 km/h; 230 mph); if a spoiler panel fails, the symmetrical opposite panel stops operating; if rudder yaw damping fails, pairs of spoiler panels are used instead; minimum-speed marker on PFD adjusts to changing aircraft configuration, airbrake and pitch rate; fuel automatically transferred between wing and tailplane tanks to minimise trim drag when cruising above 7,620 m (25,000 ft).

Engines controlled by setting throttle levers to marks on quadrant, such as climb (CLB), maximum continuous and flexible take-off (Flex T-O); digital engine control makes detailed settings appropriate to altitude and temperature.

During landing and take-off, nosewheel steering, by rudder pedals, automatically disengages above 100 kt (185 km/h; 115 mph); demands for more than 4°/s nose-up pitch restrained near ground; maximum airspeeds for flaps and slats signalled on airspeed scale; trim automatically cancels effect of flaps, landing gear and airspeed; ailerons droop with full flap selection and deflect 25° up with spoilers in lift dump after touchdown; thrust reverser failure automatically countered by cancelling symmetrical opposite reverser; voice warning demands throttle closure at 6 m (20 ft) during landing flare; autothrottle disengaged when throttles closed at touchdown; on touch-and-go landing, trim automatically reset for take-off when Flex T-O power selected; engine failure in flight compensated automatically, with wings held level, slight heading drift and spoiler panels sucked down to avoid unnecessary drag. A340-600 has forward-facing taxi-aid cameras mounted in fin and belly fairing to assist pilots during ground manoeuvres.

STRUCTURE: A330 and A340 wings almost identical except latter strengthened in area of outboard engine pylon with appropriate modification of leading-edge slats 4 and 5; main three-spar wing box and leading/trailing-edge ribs and fittings of aluminium alloy, with Al-Li for some secondary structures; steel or titanium slat supports; approximately 13 per cent (by weight) of wings is of CFRP, GFRP or QFRP, including outer flaps and flap track fairings, ailerons, spoilers, leading/trailing-edge fixed surface panels and winglets; common fuselage for all initial versions, except in overall length (A340-300 same size as A330-300; A340-200 and A330-200 respectively eight and ten frames shorter; A340-500 and A340-600 described above; see also dimensions, below); construction generally similar to that of A310 and A300-600 except centre-section to accept new wing; tail unit (common to all versions except A330-200 and A340-500/600, which have larger tailplane, fin and rudder) utilises same CFRP fin as A300-600 and A310; new tailplane incorporates trim fuel tank and has CFRP outer main boxes bridged by aluminium alloy centre-section. A340-500/600 have Aircelle nacelles constructed from carbon composites.

Work-sharing along lines similar to those for A310 and A300-600, with percentages similar to those held in the original consortium, Airbus France thus responsible for flight deck, engine pylons, part of centre-fuselage, centre-section cabin doors wing-to-body fairings and final assembly and outfitting at Toulouse; Airbus UK for wings and landing gear; Airbus Deutschland for most of fuselage, tailcone, fin, wing moving surfaces, cabin doors and interior; Airbus España for tailplane and forward starboard cabin doors; Belgian consortium Belairbus for leading-edge slats and slat tracks, Aircelle for engine nacelles, Japanese contributions from Bridgestone (tyres), Furukawa/Sky Aluminium (metal/plastics

interfaces) and ShinMaywa (wing walkways), Airbus Deutschland (Bremen) developing lightweight spoiler for 2006 introduction. Before final assembly at Toulouse, Saint Nazaire (Airbus France) pre-assembles flight deck and three forward fuselage sections; and two (of three) rear fuselage sections.

LANDING GEAR: Main (four-wheel bogie) and twin-wheel nose units identical on all A330/340 versions. Main tyres size 54x21.0-23 or 46x17.0R20 or 1400x530R23 (32/36 ply); nose tyres 40.5x15.5-6 or 30x8.8R15 or 1050x395R16 (28 ply). A340-200/300 have additional twin-wheel auxiliary unit on fuselage centreline amidships, retracting rearward; A340-500 and -600 have four-wheel centre bogie, retracting forward. Goodyear tyres available on all units; Michelin and Bridgestone tyres also available for A340-500/600.

POWER PLANT: Four 138.8 kN (31,200 lb st) CFM56-5C2 turbofans initially; 144.6 kN (32,500 lb st) CFM56-5C3 and 151.2 kN (34,000 lb st) CFM56-5C4/P; CFM56 upgrade announced in July 2000, combining CFM56-5C with core of CFM56-3B/P. Rolls-Royce Trent 553-61 of 248 kN (55,780 lb st) in A340-500; Trent 556-61 of 260 kN (58,460 lb st) in A340-600.

A340-200/300: Maximum fuel capacity; (-200 and -300 until 1996) 138,600 litres (36,614 US gallons; 30,488 Imp gallons); (-200/300 1996-97) 140,640 litres (37,154 US gallons; 30,937 Imp gallons); (-200, 300, 1997 and subsequent deliveries) 141,500 litres (37,381 US gallons; 31,126 Imp gallons); (-200/300, 1997 and subsequent deliveries, including optional ACT) 148,700 litres (39,283 US gallons; 32,710 Imp gallons). Totals include 6,230 litres (1,646 US gallons; 1,370 Imp gallons) in tailplane trim tank.

A340-500: Capacity 214,405 litres (56,641 US gallons; 47,164 Imp gallons) total, including 771 litres (204 US gallons; 170 Imp gallons) unusable. Centre and wing group tanks as for A340-600; plus rear centre tank of 19,883 litres (52,500 US gallons; 43,716 Imp gallons) and trim tank of 8,011 litres (2,116 US gallons; 1,762 Imp gallons).

A340-600: Capacity 194,897 litres (51,511 US gallons; 42,892 Imp gallons) total, including 761 litres (201 US gallons; 167 Imp gallons) unusable. Centre tank of 55,373 litres (14,732 US gallons; 12,181 Imp gallons), trim tank of 8,386 litres (2,215 US gallons; 1,845 Imp gallons) and six wing tanks; tanks 1/4 of 49,070 litres (12,963 US gallons; 10,794 Imp gallons), tanks 2/3 of 69,744 litres (18,425 US gallons; 15,342 Imp gallons) and outer tanks with combined 12,324 litres (3,256 US gallons; 2,711 Imp gallons).

ACCOMMODATION: Crew of two on flight deck (all versions); flight deck can be supplied with humidifier system. Passenger seating typically six-abreast in first class, six-abreast in business class and eight-abreast in economy (nine-abreast optional), all with twin aisles. A typical three-class layout seats 295 in A340-300, 239 in the A340-200, 313 in A340-500 and 380 in A340-600. Single-class seating capacities for A340-300/200/500/600 are 440, 420, 375 and 475 respectively. A340-300 is available with optional, removable, lower deck crew rest module, replacing pallet in rear cargo hold with a sleeper cabin for seven or eight cabin crew. Optional lower deck facilities in rear cargo hold of -600 include an area with stand-up headroom and lavatories plus up to eight crew rest bunks and galleys. A further facility is under study for -500 and -600 that could offer up to 10 full-length beds for passengers or a lower-deck lounge. A340-600 (except prototype) has two overwing Type III emergency exits in addition to standard eight Type A doors. Underfloor cargo holds house up to 32 LD3 containers or 11 standard 2.24 x 3.17 m (88 x 125 in) pallets in A340-300, 26 LD3s or nine pallets in A340-200, 30 LD3s or 10 pallets in A340-500, and 42 LD3s or 14 pallets in A340-600; front and rear cargo holds have doors wide enough to accept 2.44 x 3.17 m (96 x 125 in) pallets; all versions have a 19.7 m³ (695 cu ft) bulk cargo hold aft of the rear cargo hold.

SYSTEMS: Hamilton Sundstrand GTCP 331-350C APU.

AVIONICS: Airbus Future Air Navigation System (FANS-A), comprising Smiths Industries digital control and display system married to Honeywell FMS, underwent testing end 1999 and was certified July 2000; can be retrofitted to all A330/A340s. Tenzing Communications in-flight e-mail/Internet access system was successfully tested on an A340-600 during flight testing with a full passenger load.

DIMENSIONS, EXTERNAL:

Wing span: A340-200/300	60.30 m (197 ft 10 in)
A340-500/600	63.45 m (208 ft 2 in)
Wing chord at root: A340-200/300	10.60 m (34 ft 9 1/4 in)
A340-500/600	12.20 m (40 ft 0 1/4 in)
Wing aspect ratio: A340-200/300	10.1
A340-500/600	9.2
Length overall: A340-200	59.42 m (194 ft 11 1/4 in)
A340-300	63.68 m (209 ft 11 in)
A340-500	67.51 m (221 ft 6 in)
A340-600	74.96 m (245 ft 11 in)
Fuselage: Max diameter (all versions)	5.64 m (18 ft 6 in)
Height overall:	
A340-200/-300	16.84 m (55 ft 3 in)
A340-500/-600	17.75 m (58 ft 3 in)
Tailplane span: A340-300	19.41 m (63 ft 8 in)
A340-500/-600	22.96 m (75 ft 4 in)
Wheel track (all versions)	10.69 m (34 ft 5 in)
Wheelbase: A340-200	23.47 m (77 ft 0 in)
A340-300	25.40 m (83 ft 4 in)
A340-500	27.58 m (90 ft 6 in)
A340-600	32.89 m (107 ft 11 in)

DIMENSIONS, INTERNAL:

Cabin:	
Length (excl flight deck):	
A340-200	46.08 m (151 ft 2 in)
A340-300	50.34 m (165 ft 2 in)
A340-500	53.54 m (175 ft 8 in)
A340-600	60.99 m (200 ft 1 in)
Max width	5.28 m (17 ft 4 in)
Max height	2.40 m (7 ft 10 1/2 in)
Underfloor baggage/cargo holds:	
Max height	1.70 m (5 ft 7 in)
Width at floor	3.175 m (10 ft 5 in)
Volume: forward hold:	
A340-300/-500 standard	69.1 m³ (2,442 cu ft)
A340-300/-500 option	80.5 m³ (2,844 cu ft)
A340-600 standard	92.2 m³ (3,256 cu ft)
A340-600 option	107.4 m³ (3,792 cu ft)
Volume: rear hold:	
A340-300 standard	55.6 m³ (1,965 cu ft)
A340-300 option	62.6 m³ (2,212 cu ft)
A340-500 standard	46.1 m³ (1,628 cu ft)
A340-500 option	53.7 m³ (1,896 cu ft)
A340-600 standard	69.1 m³ (2,442 cu ft)
A340-600 option	80.5 m³ (2,844 cu ft)

Volume: bulk hold (all versions)	19.7 m ³ (695 cu ft)
AREAS:	
Wings, gross:	
A340-200/-300	361.60 m ² (3,892.2 sq ft)
A340-500/-600	437.00 m ² (4,703.8 sq ft)
WEIGHTS AND LOADINGS:	
Operating weight empty:	
A340-200 current	129,500 kg (285,500 lb)
A340-300 basic	129,300 kg (285,050 lb)
A340-300 option	130,200 kg (287,050 lb)
A340-500 basic	170,900 kg (376,770 lb)
A340-500 option	174,800 kg (385,375 lb)
A340-600 basic	177,800 kg (391,975 lb)
A340-600 option	181,900 kg (401,025 lb)
Baggage capacity:	
A340-200:	
forward hold	18,507 kg (40,801 lb)
rear hold	15,241 kg (33,601 lb)
bulk hold	3,468 kg (7,646 lb)
A340-300:	
forward hold	22,861 kg (50,400 lb)
rear hold	18,507 kg (40,801 lb)
bulk hold	3,468 kg (7,646 lb)
A340-500:	
forward hold	24,494 kg (54,000 lb)
rear hold	16,330 kg (36,001 lb)
bulk hold	3,458 kg (7,624 lb)
A340-600:	
forward hold	30,482 kg (67,201 lb)
rear hold	22,861 kg (50,400 lb)
bulk hold	3,468 kg (7,646 lb)
Max payload (maximum weight options):	
A340-200: initial	43,500 kg (95,900 lb)
A340-300 basic	50,900 kg (112,215 lb)
A340-500	54,100 kg (119,270 lb)
A340-600	64,300 kg (141,755 lb)
Max T-O weight:	
A340-200: basic	253,500 kg (558,875 lb)
option	257,000 kg (566,600 lb)
A340-300: basic	275,000 kg (606,275 lb)
option	276,500 kg (609,575 lb)
A340-500: basic	368,000 kg (811,300 lb)
option 1	372,000 kg (820,125 lb)
option 2	380,000 kg (837,750 lb)
A340-600: basic	365,000 kg (804,675 lb)
option 1	368,000 kg (811,300 lb)
option 2	380,000 kg (837,750 lb)
Max ramp weight:	
A340-200: basic	254,400 kg (560,850 lb)
option	257,900 kg (568,575 lb)
A340-300: basic	275,900 kg (608,250 lb)
option	277,400 kg (611,550 lb)
A340-500: basic	369,200 kg (813,950 lb)
option 1	373,200 kg (822,750 lb)
option 2	381,200 kg (840,400 lb)
A340-600: basic	366,200 kg (807,325 lb)
option 1	369,200 kg (813,950 lb)
option 2	381,200 kg (840,400 lb)
Max landing weight:	
A340-200	181,000 kg (399,025 lb)
A340-300 basic	190,000 kg (418,875 lb)
A340-300 option	192,000 kg (423,275 lb)
A340-500: basic	240,000 kg (529,105 lb)
option 1	243,000 kg (535,725 lb)
option 2	246,000 kg (542,325 lb)
A340-600 basic	256,000 kg (564,380 lb)
option 1	259,000 kg (570,995 lb)
option 2	265,000 kg (584,225 lb)
Max zero-fuel weight:	
A340-200	169,000 kg (372,575 lb)
A340-300 basic	178,000 kg (392,425 lb)
A340-300 option	181,000 kg (399,025 lb)
A340-500: basic	225,000 kg (496,050 lb)
option 1	230,000 kg (507,075 lb)
option 2	232,000 kg (511,475 lb)
A340-600: basic	242,000 kg (533,525 lb)
option 1	245,000 kg (540,125 lb)
option 2	251,000 kg (553,350 lb)
Max wing loading:	
A340-200: basic	701.0 kg/m ² (143.59 lb/sq ft)
option	710.7 kg/m ² (145.57 lb/sq ft)
A340-300: basic	760.5 kg/m ² (155.76 lb/sq ft)
option	764.7 kg/m ² (156.61 lb/sq ft)
A340-500: basic	842.1 kg/m ² (172.48 lb/sq ft)
option 1	851.3 kg/m ² (174.35 lb/sq ft)
option 2	869.6 kg/m ² (178.10 lb/sq ft)
A340-600: basic	835.2 kg/m ² (171.07 lb/sq ft)
option 1	842.1 kg/m ² (172.48 lb/sq ft)
option 2	869.6 kg/m ² (178.10 lb/sq ft)
PERFORMANCE:	
Max operating Mach No. (MMO)	0.86
Max operating speed	330 kt (611 km/h; 380 mph) IAS
Typical operating Mach No.:	
A340-200/300	0.82
A340-500/600	0.83
Stalling speed:	
A340-300, at 267,000 kg (588,625 lb), wheels up:	
flaps up	161 kt (299 km/h; 186 mph)
flaps down	133 kt (247 km/h; 153 mph)
Max certified altitude: all	12,525 m (41,100 ft)
T-O field length at S/L, basic MTOW, ISA + 15°C:	

A340-200	3,017 m (9,900 ft)
A340-300	3,125 m (10,250 ft)
A340-500 (estimated)	3,125 m (10,250 ft)
A340-600	3,140 m (10,300 ft)
Range at typical OWE, international allowances and 200 n mile (370 km; 230 mile) diversion:	
A340-200 with 239 passengers	8,000 n miles (14,816 km; 9,206 miles)
A340-300 with 295 passengers:	
basic	7,200 n miles (13,334 km; 8,285 miles)
optional	7,400 n miles (13,704 km; 8,515 miles)
A340-500 with 313 passengers	8,650 n miles (16,019 km; 9,954 miles)
A340-600 with 380 passengers:	
basic	7,500 n miles (13,890 km; 8,630 miles)
OPERATIONAL NOISE LEVELS (at basic MTOW):	
T-O, fly-over: A340-300	95.6 EPNdB
A340-600	93.5 EPNdB
Sideline: A340-300	96.1 EPNdB
A340-600	95.5 EPNdB
Approach: A340-300	96.9 EPNdB
A340-600	99.9 EPNdB

AIRBUS A330

TYPE: Wide-bodied airliner.
PROGRAMME:

DEVELOPMENT MILESTONES

A330-300	
Launched	5 Jun 87
First flight	2 Nov 92
Certification	21 Oct 93
First delivery (Air Inter)	30 Dec 93
Entered service (Air Inter)	17 Jan 94
Subsequent versions	
A330-200	
Launched	24 Nov 95
First flight	13 Aug 97
Public debut	16 Nov 97
Certification	31 Mar 98
First delivery (Canada 3000)	29 May 98

Twin-engined A330 was developed simultaneously with four-engined A340; launched 5 June 1987; first flight (F-WWKA) with GE engines 2 November 1992; first R-R Trent 700-powered A330 flew 31 January 1994; simultaneous European and US certification with initial GE CF6-80E1 engines received 21 October 1993; first delivery (Air Inter) December 1993, entered service January 1994; certification with PW4164/4168 obtained 2 June 1994; A330 powered by GE CF6-80E1 with FADEC granted 120-minute ETOPS approval May 1994; Aer Lingus flew first ETOPS services across the Atlantic in May 1994; A330 powered by PW4164/4168 granted 90-minute ETOPS approval November 1994; certification with R-R Trent achieved 22 December 1994; 90-minute ETOPS approval granted before first delivery, to Cathay Pacific Airways, 24 February 1995. Further extensions of ETOPS to 180 minutes granted on 6 February 1995 (GE engines), 4 August 1995 (P&W) and 17 June 1996 (R-R); 180-minute ETOPS for PW4168A-powered A330-300 granted July 1999; and for -200 and -300 with Trent 772Cs on 20 April 2006.

All main structural and systems information common to both A330 and A340 is listed in A340 entry. Differences in A330 given here.

CURRENT VERSIONS: **A330-300:** Baseline version; seating capacity 295 in three classes (12 first, 42 business, 241 economy). Payload increase of 7,000 kg (15,432 lb) offered for standard A330-300 in October 1993. Maximum T-O weight increased to 217,000 kg (478,400 lb) from November 1995 to allow typical 335 passengers to be carried 4,850 n miles (8,982 km; 5,581 miles), further increase to 230,000 kg (507,050 lb) with range increased to 5,600 n miles (10,370 km, 6,444 miles) offered in 1997; first aircraft to this standard ordered by Air Canada in 1997, but first in service was a Korean Air example in May 1999. Optional higher maximum T-O weight of 233,000 kg (513,675 lb) available from early 2001; earlier 230,000 kg (507,050 lb) versions can be retrofitted.

A330-200: Extended-range version; launched 24 November 1995; 10-frame reduction in fuselage length to 59.00 m (193 ft 6¾ in); maximum T-O weight 230,000 kg (507,050 lb); higher MTOW available from early 2001, as per A330-300. 253 passengers in three classes (12 first, 36 business, 205 economy) or 293 passengers in two classes; range with 253 passengers 6,650 n miles (12,315 km; 7,652 miles); engine choice as for A330-300; initial order, for 13, placed in March 1996 by ILFC. First flight (c/n 181, F-WWKA, with CF6-80E1 engines) 13 August 1997 was followed by public debut at Dubai Air Show in November 1997. Canada 3000 first user (on lease from ILFC) with first flight of production aircraft (C-GGWA) 20 January 1998 and delivery on 29 May 1998 following FAA/JAA/Transport Canada certification on 31 March 1998. First direct airline order from Korean Air, received second built in June 1998 (c/n 195, with PW4000 engines) following 4 December 1997 first flight and May 1998 certification. Version with Rolls-Royce Trents (re-engined first prototype) flew 24 June 1998 and following JAR and Transport Canada certification in January 1999 was delivered to Air Transat in February 1999. First with uprated CF6-80A1A3s delivered to Air France 17 December 2001.

AirTanker consortium bid for UK Future Strategic Tanker Aircraft (FSTA) contract offered A330-200 tankers, using new airframes converted by Cobham, which would enter service in 2007; selected as preferred platform January 2004.

A330-100: Proposed nine-frame reduction of A330-200; not built.

A330-200F: Proposed freighter version; possible DC-10/MD-11 replacement; planned launch at Paris Air Show in June 2001 was deferred to unspecified date; re-surfaced mid-2006, with formal launch then expected before year-end (though not announced by mid-November) and service entry forecast for fourth quarter 2009. Reported letter of intent for 30 from unidentified customer. Maximum payload 64,300 kg (141,755 lb) over 4,000 n miles (7,408 km; 4,603 miles). Capacity for 23 2.24 × 3.17 m (88 × 125 in) pallets or containers, or 22 size 2.44 × 3.17 m (96 × 125 in) on main deck; and a combination of up to eight such pallets and two LD3 containers on the lower deck. Max fuel capacity 139,090 litres (36,744 US gallons; 30,596 Imp gallons). OWE 108,700 kg (239,640 lb); MTOW 233,000 kg (513,675 lb); MLW 182,000 kg (401,240 lb); MZFW 173,000 kg (381,400 lb). Main deck cargo door same size as on A300-600F. Cross-crew qualification with A320/A340/A380 families. Estimated market for 200 aircraft over 10 years.

A330-500: Proposed eight-frame reduction of A330-200, announced July 2000 and initially internally designated A330-M18; suspended in favour of A380 programme.

A350: Originally an A330 derivative; now described separately.



Airbus A330-200 of Yemen Airways (Yemenia)

1158615

AIRBUS A330 MARKS AND VARIANTS

Series	Mark	Power Plant	FAA Certification
200	201	CF6-80E1A2	1 Apr 03
200	202	CF6-80E1A4	31 Mar 98
200	203	CF6-80E1A3	1 Nov 02
200	223	PW4168A	21 Jun 99
200	243	Trent 772B-60	21 Dec 00
300	301	CF6-80E1A2	21 Oct 93
300	321	PW4164	21 Jun 99
300	322	PW4168	21 Jun 99
300	323	PW4168A	8 Oct 99
300	341	Trent 768-60	21 Dec 00
300	342	Trent 772-60	21 Dec 00
300	343	Trent 772B-60	21 Dec 00

Series	Variant	MTOW (kg)
200	020	230,000
300	000	212,000
300	001	184,000
300	002	212,000
323/343 only	020	230,000
323 only	022	233,000
323 only	050	230,000
323 only	052	233,000

Notes: Variant parameters may include differences in data other than max T-O weight. Except as constrained by Series. Variants are applicable to several engine options.

CUSTOMERS: Total of 595 sold, of which 437 delivered, by 1 November 2006. See table.

AIRBUS A330 ORDERS
(at 1 November 2006)

Customer	Version	Qty
Aer Lingus	200,300	5
Air Algérie	200	5
Air Caledonie International	200	2
Air Canada	300	8
Air Caribes	300	1
Air China	200	20
Air France group	200	8
Air Inter Europe	300	4
Air Mauritius	200	2
Asiana Airlines	300	6

Customer	Version	Qty
Austrian Airlines	200	3
British Midland Airways	200	1
Cathay Pacific Airways	300	26
China Airlines (Taiwan)	300	14
China Eastern Airlines	200, 300	20
China Southern Airlines	200, 300	14
CIT Leasing	200, 300	20
Corsair	200	2
Dragonair	300	5
Egyptair	200	7
Emirates	200	28
Etihad	200	12
EVA Air	200	3
Flightlease	200	9
Garuda Indonesia	300	9
GECAS	200	20
Gulf Air	200	6
ILFC	200, 300	95
Jet Airways	200	10
Kingfisher Airlines	200	5
KLM	200	6
Korean Air	200, 300	19
LTU	300	5
Lufthansa	300	15
Malaysia Airlines	300	10
Monarch Airlines	200	2
MyTravel Airways	200, 300	7
Northwest Airlines	200, 300	40
Philippine Airlines	300	8
Qantas	200, 300	16
Qatar Airways	200, 300	26
Royal Australian Air Force	200	5
Sabena	200	3
SAS	300	4
SriLankan Airlines	200	6
Swissair	200	4
TAM	200	5
TAP-Air Portugal	200	5
Thai Airways International	300	12
Turk Hava Yollari	200	5
US Airways	200, 300	19
Private customers	200	3
Total		595



Cyprus Airways A330-200 en route, against an inhospitable background

1158614

COSTS: A330-200 USD135.3 million; A330-300 USD150.6 million (2002).

FLYING CONTROLS: Control surface maximum deflections: ailerons ±25°; aileron droop 10°; elevator +15°/-30°; rudder ±30°; flaps 32°; No. 1 spoiler, speed brake 23°, lift dumper 35°; Nos. 2 to 6 spoilers, roll 35°, speed brake 30°, lift dumper 50°; slats 23°; stabilisers +2°/-14°.

POWER PLANT: Two turbofans. Initial application was 287 kN (64,530 lb st) GE CF6-80E1A2 turbofans (297 kN; 64,530 lb st E1A4 on longer-range version); alternative engines, using common pylon and mount, GE CF6-80E1A3 (each 305 kN; 68,530 lb st), P&W PW4168/A (305 kN; 68,600 lb st), R-R Trent 772-60/772B-60A (316 kN, 71,100 lb st), PW4164 (287 kN; 64,500 lb) and Trent 768-60 (300 kN; 67,500 lb st).

Fuel capacities: A330-200: Total 139,527 litres (36,860 US gallons; 30,693 Imp gallons), of which 437 litres (115.4 US gallons; 96.1 Imp gallons) unusable. Wing tanks total 91,648 litres (24,212 US gallons; 20,160 Imp gallons); centre tank 41,643 litres (11,001 US gallons; 9,160 Imp gallons); trim tank 6,236 litres (1,647 US gallons; 1,372 Imp gallons).

A330-301/321/322/341/342: Total 97,525 litres (25,764 US gallons; 21,453 Imp gallons), of which 354 litres (93.4 US gallons; 77.9 Imp gallons) unusable. Wing tanks total 91,404 litres (24,147 US gallons; 20,107 Imp gallons); trim tank 6,121 litres (1,617 US gallons; 1,346 Imp gallons).

A330-323/343: Total 98,239 litres (25,952 US gallons; 21,610 Imp gallons), of which 354 litres (93.4 US gallons; 77.9 Imp gallons) unusable. Wing tanks total 92,112 litres (24,334 US gallons; 20,262 Imp gallons); trim tank 6,127 litres (1,619 US gallons; 1,348 Imp gallons).

ACCOMMODATION: A330-200 and -300 certified for 375 passengers, with three pairs of Type A and one pair of Type I emergency exits, or 379 passengers with four pairs of Type A exits.

DIMENSIONS, EXTERNAL: As A340-200/300 except:

Length overall: A330-200 59.00 m (193 ft 7 in)
A330-300 63.58 m (208 ft 7 in)
Height overall: A330-200 17.88 m (58 ft 8 in)
A330-300 16.84 m (55 ft 3 in)

DIMENSIONS, INTERNAL: As A340-200/300 except:

Underfloor baggage/cargo holds:

Volume: forward hold:

A330-200 basic 55.0 m³ (1,944 cu ft)
A330-200 option 62.6 m³ (2,212 cu ft)
A330-300 basic 69.1 m³ (2,442 cu ft)
A330-300 option 80.5 m³ (2,844 cu ft)

Volume: rear hold:

A330-200 basic 46.1 m³ (1,628 cu ft)
A330-200 option 53.7 m³ (1,896 cu ft)
A330-300 basic 55.6 m³ (1,965 cu ft)
A330-300 option 62.6 m³ (2,212 cu ft)

Volume: bulk hold (all versions) 19.7 m³ (695 cu ft)

WEIGHTS AND LOADINGS (C: with CF6-80E1A3/A4, P: with PW4168A, T: with Trent 772B):

Operating weight empty, basic versions, three-class layout: C 120,500 kg (265,655 lb)
P 121,100 kg (266,980 lb)
T 120,600 kg (265,875 lb)
A330-300: C 124,500 kg (274,475 lb)
P 125,100 kg (275,800 lb)
T 124,600 kg (274,695 lb)

Baggage capacity:

A330-200:

forward hold 18,869 kg (41,599 lb)
rear hold 15,241 kg (33,601 lb)
bulk hold 3,468 kg (7,646 lb)

A330-300:

forward hold 22,861 kg (50,400 lb)
rear hold 18,507 kg (40,800 lb)
bulk hold 3,468 kg (7,646 lb)

**Max payload, basic versions: A330-200: C 47,500 kg (104,720 lb)
P 46,900 kg (103,395 lb)
T 47,400 kg (104,500 lb)
A330-300: C 48,500 kg (106,925 lb)
P 47,900 kg (105,600 lb)
T 48,400 kg (106,705 lb)**

Max ramp weight:

A330-200/-300: basic 230,900 kg (509,045 lb)
option 233,900 kg (515,660 lb)

Max T-O weight:

A330-200/-300: basic 230,000 kg (507,060 lb)
option 233,000 kg (513,675 lb)

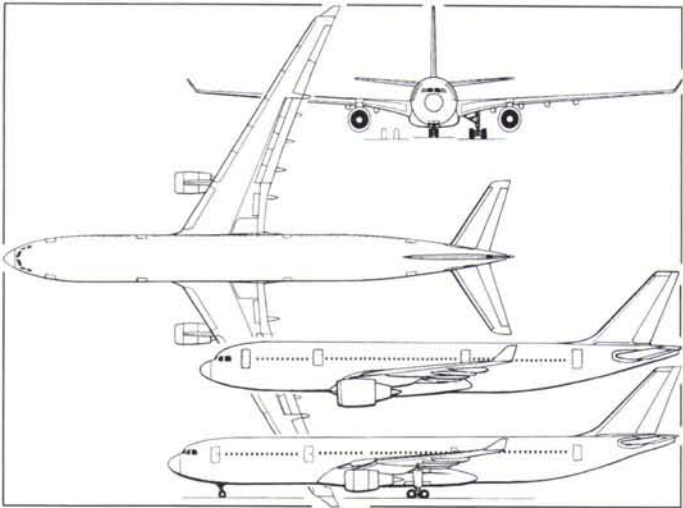
Max landing weight:

A330-200 basic 180,000 kg (396,825 lb)
A330-200 option 182,000 kg (401,250 lb)
A330-300 basic 185,000 kg (407,855 lb)
A330-300 option 187,000 kg (412,265 lb)

Max zero-fuel weight:

A330-200 basic 168,000 kg (370,375 lb)
A330-200 option 170,000 kg (374,775 lb)
A330-300 basic 173,000 kg (381,400 lb)
A330-300 option 175,000 kg (385,810 lb)

Max wing loading:



Airbus A330-300 twin-turboprop airliner, with additional side-view of A330-200 (James Goulding) 1158566

A330-200/-300 basic	633.4 kg/m² (129.74 lb/sq ft)
A330-200/-300 option	644.4 kg/m² (131.97 lb/sq ft)
PERFORMANCE:	
Max operating Mach No. (MMO)	0.86
Max operating speed	360 kt (666 km/h; 414 mph) IAS
Typical operating Mach No.	0.82
Max certified altitude	12,525 m (41,100 ft)
T-O field length at S/L, ISA + 15°C, Trent 772B engines:	
A330-200, basic MTOW	2,530 m (8,300 ft)
A330-200, option MTOW	2,652 m (8,700 ft)
A330-300, basic MTOW	2,515 m (8,250 ft)
A330-300, option MTOW	2,606 m (8,550 ft)
Landing field length at S/L, ISA + 15°C, Trent 772B engines:	
A330-200, option MLW	1,722 m (5,650 ft)
A330-200, option MLW	1,753 m (5,750 ft)
Range, typical OWE plus max passengers, international allowances and 200 n mile (370 km; 230 mile) diversion:	
A330-200 at option MTOW	6,650 n miles (12,315 km; 7,652 miles)
A330-300 at option MTOW	5,600 n miles (10,371 km; 6,444 miles)
OPERATIONAL NOISE LEVELS (A330-300, A: 217,000 kg (478,400 lb) with Trent 768; B: 230,000 kg (507,050 lb) with Trent 772):	
T-O, flyover: A	89.8 EPNdB
B	98.0 EPNdB
Sideline: A	96.5 EPNdB
B	101.0 EPNdB
Approach: A	96.8 EPNdB
B	104.0 EPNdB

AIRBUS A350

Promotional designation: A350 XWB

TYPE: Wide-bodied airliner.

PROGRAMME: Earlier hints of project, as counter to longer-range variants of Boeing 787 Dreamliner, gained credence at Farnborough Air Show, July 2004; A350 designation confirmed two months later. Originally conceived as lighter-weight, longer-range A330 derivative, achievable by 'maximum effect with minimum change'. However, reappraisal in 2004-05 resulted in virtually new design having only some 10 per cent commonality with A330, while retaining almost identical external appearance. Go-ahead approved 10 December 2004. Original basic definition frozen in late April 2005, and go-ahead announced 6 October 2005, with service entry then targeted for mid-2010. However, major reappraisal took place during first half of 2006 as result of airline feedback, resulting in fresh presentation 17 July 2006 at Farnborough International Air Show, now of much-revamped design with title A350 XWB, indicating eXtra Wide Body, and three additional projected variants.

Following formal programme launch on 1 December 2006, revised programme for XWB now looking at design freeze in third quarter 2008; first flight mid-2011; service entry in mid-2012 for A350-900, with -800 following in about 1Q13 and -1000 in 1Q14.

CURRENT VERSIONS: **A350-800:** Up to 270 passengers in three-class configuration; 334 kN (75,000 lb st) class engines.

A350-900: Up to 314 passengers in three-class configuration; 387 kN (87,000 lb st) class engines.

A350-900F: Freighter version of -900.

A350-900R: Ultra-long-range version of -900.



By some airlines' standards, Dragonair's A330-300s may seem a little overdressed

1158616



Computer-generated impression of the revamped A350 XWB 1154692

A350-1000: Up to 350 seats in three-class configuration or 375 in all-economy class; 423 kN (95,000 lb st) class engines.

CUSTOMERS: Conditional orders for 140 of original A350 by October 2005 from Air Europa (10 -800s plus two on option; first to commit, in December 2004); US Airways (20); Qatar Airways (60 -800/900s); GECAS (10); Kingfisher (five -800s); TAM (eight -900s); Alafco (12 -800s plus six on option); CIT Group (five); plus 10 undisclosed.

Firm orders 100 (69 -800s and 31 -900s) for XWB by mid-November: see table. Additional commitments at that time for 122: Bangkok Airways (six), China Aviation Supplies (20), GECAS (10), Qatar Airways (60), Singapore Airlines (20) and Yemenia (six). Break-even estimated at approximately 450 sales.

AIRBUS A350 ORDERS (at mid-November 2006)		
Customer	Version	Qty
Air Europa	800	10
	800	12
	800	5
	800	3
	900	9
	800	8
Finnair	900	8
	800	8
	900	5
TAM	900	10
	800	6
TAP-Air Portugal	900	4
	800	20
US Airways	800	20
Total		100

DESIGN FEATURES: Major changes compared with original A350 design (see 2006-07 *Jane's All the World's Aircraft*) are: (1) a new cabin cross-section 0.305 m (12 in) wider than the A330, with parallel section from door 1 to door 4 and 51 cm (2 in) wider panoramic windows; (2) new wing with 3° more sweep, increasing econ cruising Mach number to 0.85; (3) new engines (see Current Versions) offering more thrust, a 2 per cent improvement in sfc and 5 per cent lower maintenance costs; and (4) new systems derived from the A380, 10 per cent lower airframe maintenance, and fly-by-wire pilot commonality with A320/340/380.

Wing sweepback increased to 33° at quarter-chord.

FLYING CONTROLS: Inboard wing slats replaced by A380-type 'droop nose' leading-edges.

STRUCTURE: Generally as for A330, but materials breakdown differs, with most of structure now made up of composites (45 per cent), Al-Li (17 per cent), steel, aluminium and titanium, CFRP used extensively in wings, keel, floor beams and rear pressure bulkhead; Al-Li in fuselage; titanium for engine pylons; 'Glare' fibre/metal laminate for parts of upper fuselage. Laser welding of some fuselage panels. Three-spar CFRP wings with metal ribs. Planned to outsource about 5 per cent of manufacture to China and 3 per cent to Russia.

LANDING GEAR: Generally similar to A330, but structural weight-saving obviates need for centre-fuselage bogies. Messier-Dowty main units.

POWER PLANT: Twin Rolls-Royce Trent XWB turbofans on all versions initially; General Electric GENx alternative may be offered for -800 and -900 later. Fuel capacity 142,421 litres (36,750 US gallons; 30,601 Imp gallons).

ACCOMMODATION: Two pilots and eight cabin crew. Twin-aisle layout with typical seating capacity as listed under Current Versions, eight (2-4-2) or nine abreast (3-3-3) in economy and six abreast (2-2-2) in first/business class. Modular cabin, designed to be re-configurable overnight.

Underfloor capacity (-800) 26 LD3 containers or eight pallets and two LD3s; or (-900) 11 pallets or 34 LD3s; plus, in both cases, bulk cargo volume. Rest areas for flight crew below flight deck, for cabin crew above rear bulk hold area. Economy class seats 44.5 cm (17.5 in) wide for nine-abreast layout, or 49 cm (19.25 in) for eight abreast; improved headroom (1.63 m; 5 ft 4 in) at window seats; sidewall panels resculpted to increase cabin internal width.

SYSTEMS: Electrical power generation by engine bleed air. Cabin pressurised to 1,830 m (6,000 ft) or less equivalent altitude and humidity increased to 20 per cent to improve passenger comfort. Flow management system adapts cabin airflow to passenger load as further environmental improvement. Hydraulic system 207 bar (3,000 lb/sq in). Honeywell HGT 1500 provides 1,119 kW (1,500 shp) for air conditioning, engine starting and in-flight emergency power.

AVIONICS: Flight control architecture includes A380 onboard information system, HUD, vertical display, dual integrated standby instrument system (ISIS), onboard airport navigation system and 'brake to vacate' airport guidance system. Honeywell RDR-4000 weather radar.

Following details all provisional:

DIMENSIONS, EXTERNAL:

Wing span: 800, 900 61.09 m (200 ft 5 in)

Length overall: 800	59.00 m (193 ft 6¾ in)
900	64.87 m (212 ft 10 in)
Fuselage: Max width	5.91 m (19 ft 4¾ in)
Height overall: 800	17.17 m (56 ft 4 in)
900	16.61 m (54 ft 6 in)
DIMENSIONS, INTERNAL:	
Cabin:	
Length: 800	45.57 m (149 ft 6 in)
900	51.94 m (170 ft 5 in)
Max width: 800, 900	5.36 m (17 ft 7 in)
Aisle width	
first/business class	53.3 cm (21 in)
economy class	46.4 cm (18¼ in)
Bulk hold volume: 800, 900	19.7 m³ (695 cu ft)
Total volume (pallets + LD3s + bulk cargo):	
800	114.7 m³ (4,050 cu ft)
900	147.2 m³ (5,200 cu ft)
AREAS:	
Wings, gross (reference)	362.0 m² (3,896.5 sq ft)
WEIGHTS AND LOADINGS:	
Max T-O weight:	
800	245,000 kg (540,125 lb)
900	265,000 kg (584,225 lb)
1000	290,000 kg (639,350 lb)
Max wing loading: 800	676.8 kg/m² (138.62 lb/sq ft)
900	732.0 kg/m² (149.93 lb/sq ft)
1000	801.1 kg/m² (164.08 lb/sq ft)
PERFORMANCE (estimated):	
Max operating Mach number (MMO)	0.86
Long-range cruising speed	M0.83
Econ cruising speed	M0.85
Range with max passengers and typical international reserves, incl 200 n mile (370 km; 230 mile) diversion:	
800	8,800 n miles (16,297 km; 10,126 miles)
900	7,500 n miles (13,890 km; 8,630 miles)

AIRBUS A380

TYPE: High-capacity airliner.	
PROGRAMME:	
DEVELOPMENT MILESTONES	
Programme go-ahead	8 Dec 99
First orders (Emirates and Air France)	24 Jul 00
Launched	19 Dec 00
First metal cut	23 Jan 02
Rollled out	18 Jan 05
First flight	27 Apr 05
Certified	12 Dec 06

Engineering work began in early June 1994; known as A3XX until December 2000; separate A3XX directorate (Large Aircraft Division) formed within Airbus in March 1996; concept definition began April 1996; Airbus allocated approximately 40 per cent of programme to new partners. Full-size mockup of fuselage cross-section shown at Paris in 1997; completed, including partial concept interior, in 2000.

Airbus Industry Supervisory Board authorised programme go-ahead 8 December 1999; commercial launch authorised 23 June 2000; industrial launch and A380 designation confirmed 19 December 2000, on receipt of required 50th launch order. Test programme calls for 2,200 flying hours over 15 months. Trent 900 engine began flight testing in No. 2 position on A340-300 testbed (F-WWAI) 17 May 2004. Static testing at Toulouse began 25 May 2004; fatigue testing at Dresden from November 2005.

First metal and CFRP cut at Nantes (France) 23 January 2002; at Bremen (Germany) 14 March 2002; at Varel (Germany) April 2002; at Filton (UK) 23 August 2002; at Illescas (Spain) 14 February 2003. First metal cut for wing centre-section 'bathtub' by EADS Military Aircraft at Augsburg 18 February 2003; first Saab-built wing leading-edge components delivered 24 April 2003; new Airbus UK factory at Broughton opened 31 January 2003. Six main subassemblies for static test aircraft (front, centre and rear fuselage, tailcone, tail unit and wings) arrived in Toulouse by April 2004 for final assembly. Followed in May (wings, fuselage) and June 2004 (horizontal and vertical tail surfaces) by major subassemblies for first flying prototype, MSN (Manufacturer's Serial Number) 001, which was rolled out on 18 January 2005 and made its 3 hour 54 minute maiden flight on 27 April. First CFRP and metal for centre wing box of A380-800F cut at Nantes 12 April 2005.

Static test programme (airframe 5000) started January 2005 and was due for completion by end of 2006. Fatigue testing (airframe 5001) began at Dresden September 2005 and had reached 14,500 load cycles (of 47,500 planned) by July 2006; completion due in 2008.

First four prototypes (MSN001, 002, 004 and 007) had amassed 1,626 flight hours in 496 sorties by 13 July 2006, with fifth (009) flying before end of August; cumulative hours by five aircraft 2,358 (745 flights) by 3 November 2006. As of mid-June 2006, 15 A380s had been assembled (including the two static/fatigue test airframes) and parts manufacture for MSN36 had begun. Certification targets then remained at October 2006 for Rolls-Royce version and March 2007 for the Alliance-engined A380. However, problems with wiring installations, plus Airbus internal difficulties, had caused a six to seven month delay in delivery times, with only one aircraft (for Singapore Airlines) then expected by end 2006 and total for 2007 restricted to nine. Further delivery slippage revealed on 3 October 2006 with news that initial delivery (003 to Singapore Airlines) had been rescheduled to October 2007, with next 13 to follow in 2008, 25 in 2009 and 45 (including first A380-800F) in 2010. Joint EASA/FAA certification received 12 December 2006, despite other programme problems.

CURRENT VERSIONS (SPECIFIC): MSN001 (F-WWOW): First prototype, for airframe, systems and flight trials; R-R Trent 970 engines (311 kN; 70,000 lb st). Moved to final assembly 7 July 2004. First flight 27 April 2005; Vmc (minimum unstuck speed) trials at Istres AB July 2005. Total of 277 flights, 943 hours, completed by 13 July 2006.

MSN002 (F-WXXL): Third prototype (second to be built, third to fly); first flight 3 November 2005 and to Hamburg five days later to receive first fully equipped passenger cabin; total 24 flights (89 hours) by 13 July 2006; departed 4 September 2006 on first of four early long-range flight trials; remainder 13 to 30 November 2006; eventual delivery to Etihad; R-R engines.

MSN003 (F-WWSA): Fifth to be built and flown (maiden flight 7 May 2006). Initial customer aircraft for Singapore Airlines (9V-SKA); R-R engines. Delivery rescheduled for October 2007.



A380 prototype MSN004, appropriately liveried for the occasion, visits Singapore's Changi Airport (Paul Jackson)

1158590

MSN004 (F-WWDD): Second prototype (third to be built, second to fly): first flight 18 October 2005; airframe and systems trials, then eventual delivery to Etihad; R-R Trent 970 engines. Airport compatibility visits in October/November 2005 to Frankfurt, Singapore, Melbourne, Sydney and Kuala Lumpur, and on 18 May 2006 to London Heathrow. 'Hot and high' trials in Medellin, Colombia, 11 to 13 January 2006, and cold-weather trials at Iqaluit, Canada, 6 to 10 February 2006, displaying later in latter month at Asian Aerospace show in Singapore. Total of 193 flights (588 hours) by 13 July 2006.

MSN005 (F-WWSB): Seventh to be built; second for Singapore Airlines; R-R engines. First flight 19 July 2006.

MSN006 (F-WWSC): Eighth to be built; third for Singapore Airlines; R-R engines. First flight 17 November 2006.

MSN007 (F-WWSD): Fourth flying prototype (fourth to be built): first flight 19 February 2006. To production standard; second with fully equipped cabin. Evacuation test at Hamburg 26 March 2006 (873 people exiting in 78 seconds). Two flights (total six hours) by 13 July 2006. Route-proving flights in 2006, eventual delivery to Etihad. R-R engines initially, then GP7200s.

MSN008 (F-WWSE): Ninth aircraft; fourth for Singapore Airlines; R-R engines.

MSN009 (F-WWEA): Fifth prototype; first with (and used to test and certify) GP7270 engines. Maiden flight 25 August 2006. Total 31 flights (over 110 hours) by 31 October 2006, including high-altitude tests of Addis Ababa and hot-weather trials in Abu Dhabi; cold-weather tests at Iqaluit scheduled for January 2007, then route-proving flights for Emirates and Air France.

CURRENT VERSIONS (GENERAL): A380-700: Potential short-fuselage version, more closely aligned to Boeing 747 replacement market. Not yet launched.

A380-800: Baseline launch version; nominal 555 passengers in three-class layout and range of over 8,000 n miles (14,816 km; 9,206 miles). Initial subvariants A380-841 with Trent 970 engines; A380-861 with GP7270 engines.

Following description applies to A380-800 except where indicated.

A380-800F: All-cargo version, carrying 150,000 kg (330,700 lb) of payload over 5,600 n miles (10,371 km; 6,444 miles). Initial subvariants A380-843F with Trent 977 engines; A380-863F with GP7277 engines. Some composites replaced by aluminium-lithium (Al-Li).

A380-900: Potential stretched version, initially known as A3XX-200; 12 frames longer; 656 seats in three-class layout and up to 990 at high density. Increased MTOW and fuel volume. Not yet launched.

A380 MRTB: Projected military version (multirole transport/bomber); described separately.

CUSTOMERS: Total of 166 orders and commitments by 31 December 2006 (see table). Potential market for 1,200 and over 300 cargo aircraft in A380 class up to 2020. Initial customers, on 24 July 2000, were Air France (10, plus four options); and Emirates, which committed to five A380s and two A380-800Fs, plus five options, subsequently increased to 20 passenger examples plus 10 options and 2 freighters in November 2001; further 21 of passenger version ordered 16 June 2003 and options subsequently cancelled. First recipient Singapore Airlines to receive aircraft 010 and 012, followed by Emirates with 011 and 013 and Qantas with 014. Federal Express became A380-800F launch customer in January 2001, confirming order 18 months later, but order switched to Boeing 777 in November 2006.

COSTS: Estimated development cost USD10.7 billion for whole A380 family given during June 2001, of which USD3.1 billion was sought from risk-sharing partners. Projected unit cost at launch was USD217 million for passenger version and USD233 million for freighter; revised to average unit price for A380-800 of USD265 million by mid-2002.

DESIGN FEATURES: Conventional in external appearance except for two rows of windows, but incorporates new developments in structures, materials, systems, landing gear design and aerodynamics. Dassault CATIA and IBM computer-aided design. Flight deck commonality with in-service Airbuses permits crew cross-qualification.

Fuselage is vertically orientated oval three-deck arrangement; this 'vertical ovoid' accommodates 10 passengers abreast on main deck and eight-abreast on upper deck, offering greater space per passenger than Boeing 747. Seating ranges from a nominal 555 (22 first class and 334 economy on main deck and 96 business and 103 economy on upper deck) in three-class layout to 840 in high-density, shorter-range applications. Typical launch customer layouts vary from 480 to about 550 passengers. Dual-lane boarding stair allows four-aisle boarding and deplaning through main deck.

Lower deck can accommodate shop, bar, restaurant and/or normal range of 38 LD3 cargo containers or 13 pallets and 18.4 m³ (650 cu ft) of bulk freight; main deck is large enough to accommodate two 2.44 x 2.44 m (8 ft 0 in x 8 ft 0 in) containers side by side in the freighter version.

Modifications to engines, nacelles and aerodynamics at customer request late in the launch phase have resulted in major reductions in noise levels.

Wing sweep at 25 per cent chord 35° 44' inboard, 34° 28' outboard; dihedral 5° 36'. Vertical tail sweptback 40° at 25 per cent chord.

FLYING CONTROLS: Three-section, single-slotted flaps incorporate droop-nose device to improve climb performance. Three-section ailerons and two actuators on each wing, plus eight spoilers with individual actuators. Leading-edge slats in two sections inboard of engines; three between engines; and three outboard, each side. Elevators have two panels and actuators on each side; rudder also has two panels and actuators. Flaps, ailerons and engines have all been specifically positioned to keep wake vortex at a minimum. Tailplane incidence trimmable +2/-10°. Elevator travel +20/-30°, rudders ±30°.

STRUCTURE: Extensive use of CFRP for all flaps and spoilers, rear pressure bulkhead, centre wing box (first in CFRP on any Airbus), all tail surfaces, tailcone aft of fin leading-edge intersection with fuselage, and engine cowlings; equates to 22 per cent of aircraft. Further 3 per cent is of new 'Glare' material, consisting of alternate layers of aluminium and glass fibre-reinforced adhesive which offers significant weight reduction and fatigue/damage resistance, developed by Stork Aerospace with Technical University of Delft and Netherlands National Aerospace Laboratories; tested on a German Air Force A310 from October 1999 and used on upper fuselage shell. Laser beam welding, which reduces cost and weight, used to attach stringers to lower fuselage panels. Wing leading-edge constructed of thermoplastics. Outer wings metal bonded.

Upper deck floor beams on A380-800 constructed of CFRP; those in A380-800F aluminium-lithium; throughout the structure, lighter 2524 aluminium alloys used in place of more traditional 2024.

Work allocation of major subassemblies is Airbus France (St Nazaire): flight deck and centre fuselage; Airbus Deutschland (Hamburg): forward centre fuselage, rear fuselage; Airbus Deutschland (Stade): fin and rudder; Airbus UK (Broughton): wing main panels; Airbus España: wing/fuselage fairings, belly fairing and fixed horizontal tail; Airbus France (Toulouse): engine pylons and final assembly. For more detailed breakdown, see table.

Transport of major components undertaken by purpose-built Chinese-built Ro-Ro ship (MV *Ville de Bordeaux*) from Hamburg via UK and St Nazaire (forward centre fuselage disembarked, joined to flight deck and re-embarked, accompanied by centre fuselage), the aircraft set is then transferred to barge at Bordeaux and joined by Spanish-built elements for river transport to within 80 km (50 miles) of Toulouse, completing journey by road. New 228 x 120 x 23 m (748 x 394 x 75.5 ft) component assembly hall at Airbus Deutschland's Hamburg site started 6 December 2001 and inaugurated 21 May 2003; Airbus France's 490

AIRBUS A380 ORDERS AND COMMITMENTS
(at mid-November 2006)

Airline	Passenger	Freighter	Options	Engines	Order confirmed
Air France group	10	—	—	GP7200	18 Jun 01
China Southern Airlines	5	—	—	Trent 900	28 Jan 05
Emirates	43	—	—	GP7200	4 Nov 01
Etihad Airways	4	—	—	TBD	1 Dec 04
ILFC	10	—	—	GP7200	17 Jun 01
Kingfisher Airlines	5	—	—	TBD	15 Jun 05
Korean Air	5	—	—	GP7200	23 Oct 03
Lufthansa	15	—	—	Trent 900	20 Dec 01
Penerbangan Malaysia	6	—	—	Trent 900	11 Dec 03
Qantas Airways	12	—	8	Trent 900	6 Mar 01
Qatar Airways	2	—	—	TBD	9 Dec 03
Singapore Airlines	10	—	9	Trent 900	16 Jul 01
Thai Airways International	6	—	—	TBD	awaited
United Parcel Service	—	10	—	GP7200	10 Jan 05
Virgin Atlantic Airways	6	—	—	Trent 900	25 Apr 01
Total	139	10	17		

× 250 × 46 m (1,608 × 820 × 151 ft) final assembly hall at Toulouse inaugurated 7 May 2004.

Once completed, 'green' aircraft flown to Hamburg for internal fitting out. European and Middle Eastern aircraft delivered from Hamburg; those for rest of world return to Toulouse before despatch to customer.

LANDING GEAR: Goodrich main landing gear; each four-wheel wing-mounted unit weighs 2,310 kg (5,093 lb) and each six-wheel underfuselage unit weighs 4,080 kg (8,995 lb). Messier-Dowty twin-wheel nose landing gear. Michelin AIR X NZG tyres: 1400×530 R 23 (40 ply) on A380-800 main units; pressure 15 bar (218 lb/sq in); 1270×455 R 22 (32 ply) on nose unit; pressure 14.1 bar (205 lb/sq in); corresponding sizes for -800F are 56×22.0 R 24 (40 ply) and 1400×530 R 23 (40 ply). Bridgestone (Japan) is alternative tyre supplier. Underfuselage main gear set slightly aft of underwing units. Normal steering on nose gear and rear axle of body gear; back-up steering of nose gear in event of hydraulic power loss. Carbon brakes on all main group wheels. Manoeuvring compatible with 45 m (148 ft) wide runways and 23 m (75.5 ft) wide taxiways; U-turn possible on 60 m (200 ft) wide runways, by differential braking or asymmetrical thrust; turn radius about nosewheel with 70° steering lock is 32.6 m (107 ft), about wingtip 53.8 m (177 ft); about outboard main landing gear (min taxiway width) 50.9 m (167 ft).

POWER PLANT: A380-800 is currently offered with a choice of 311 kN (70,000 lb st) Alliance (GE/P&W) GP7270 or Rolls-Royce Trent 970 turbofans; A380-800F with 340 kN (76,500 lb st) GP7277 or Trent 977. Thrust reversers on inboard engines only. Airbus Industrie and Rolls Royce signed an MoU specifying the Trent as favoured power plant in November 1996; certified in December 2005. Trent 970 initially certified at 311 kN (70,000 lb st) but derated to 302 kN (68,000 lb st), with eventual growth to 374 kN (84,000 lb st). FADEC for GP7270 under development by BAE Systems Controls and Hispano-Suiza.

Alliance GP7200 series uses same core as power plants for Boeing 747X and long-range 767. Detailed design work was due to have started in August 2001 but slipped to early 2003, with a first run achieved in March 2004, certified at 363 kN (81,500 lb st) in December 2005; first flight, in MSN009, 28 August 2006.

Standard nominal fuel capacity of both versions is 310,000 litres (81,893 US gallons; 68,192 Imp gallons); increaseable to 355,850 litres (94,007 US gallons; 78,278 Imp gallons) with optional extra fuel tanks in wing centre box for longer-range A380-800F. Pressure refuelling points below wing leading edges, each side, between engines.

ACCOMMODATION: Flight deck crew of two, located at mezzanine level between main and upper deck, with access via main deck; rest areas are provided for crew below flight deck area. Upper deck typically carrying 96 business class and 103 tourist class passengers with eight attendants on folding seats, eight galleys, seven lavatories and five crew rest bunks. Lower deck with 22 first class and 234 tourist class passengers, 12 attendants, nine galleys and 10 lavatories. Potable water capacity 1,700 litres (449 US gallons; 374 Imp gallons) normal; 2,266 litres (598 US gallons; 498 Imp gallons) optional; waste water capacity 2,100 litres (555 US gallons; 462 Imp gallons). Underfloor capacity 38 LD3 containers or 13 pallets (seven forward and six aft of centre wing box).

Five main deck and three upper deck cabin doors/Type A emergency exits on each side of fuselage; Goodrich evacuation slides, those for upper decks stored within the airframe rather than the door. Seat pitches: first class 173 cm (68 in), business class 122 cm (48 in), economy class 81 or 84 cm (32 or 33 in). Airbus 'Prestige' interior (see description of A319 for details) planned as VIP transport option.

A380F has crew doors both sides to flight deck, 12 seat crew rest and courier transit area on upper deck, with emergency exits each side; and rear door, main deck, aft of cargo door, port. Container/pallet capacity is 17 to 25 size 3.17 × 2.44 × 2.08 m (125 × 96 × 82 in) on upper deck, 29 to 33 size 3.17 × 2.44 × 2.44 m (125 × 96 × 96 in) on main deck, and 13 size 3.17 × 2.44 × 1.63 m (125 × 96 × 64 in), or 38 LD3s, on lower deck.

SYSTEMS: Integrated modular avionics (IMA) system provided by Thales Avionics in conjunction with Diehl Avionik Systeme using computing modules slotted into cabinets throughout aircraft. Rockwell Collins supplying Ethernet avionics communications infrastructure at 100 Mbit/s speed with full duplex networking. Variable frequency AC electrical generating systems to be incorporated. Cameras fitted to top of fin and under fuselage for taxiing assistance. Fuel management systems provided by Parker Aerospace including in tank sensors and wiring, avionics and software to fit into IMA system.

Eaton 345 bar (5,000 lb/sq in) hydraulic system using eight engine-driven pumps and four electric pumps. Two hydraulic networks (yellow and green) and two electrical networks (red and orange) for flight controls, each of the latter using at least two different systems in case of failure of any one; each system fully independent; thus aircraft fully controllable via either hydraulic or electrical power to control surfaces, enhancing safety. Hydraulic system uses lighter, more compact pipework compared with earlier Airbus products. Wing-



Computer-aided impression of A380F freighter in UPS livery

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mounted landing gear powered by green system; underfuselage main gear runs on yellow system. Power generation systems with 180 kVA variable frequency generators for each engine provided by Hamilton Sundstrand. P&WC PW980A 1,342 kW (1,800 shp) APU. Onboard oxygen generator (OBOGS) optional.

A380 MAJOR INTERNAL SYSTEMS SUPPLIERS

System	Supplier
Air conditioning	Hamilton Sundstrand/L'hotelier
Air data	Goodrich
APU	Pratt & Whitney Canada
Brake-by-wire	Messier-Bugatti
Cargo loading system	Goodrich
Electrical harnesses	Labinal
Electrical power distribution	ECE/Internechue
Electrical power generation	Aerolec (Thales Avionics/Goodrich)
Environmental control	Nord-Micro
Evacuation	Goodrich/Diehl Avionik
Fire detection	Siemens Cerberus/Meggitt
Flight deck displays	Thales Avionics/Diehl Avionik
Flight management	Honeywell
Fuel distribution	FR HiTEMP/Internechue
Fuel quantity and management	Parker Aerospace
Hydraulic	Eaton Corporation
Ice detection	Goodrich
Oxygen	Dräger/AirLiquide
Pneumatic	Honeywell
Primary flight controls	Goodrich (ailerons, elevators and rudder); Liebherr (spoilers)
Ram-air turbine (emergency electrical power generation)	Hamilton Sundstrand
Supplementary cooling	Fairchild Controls/Microtecnica
Water and waste management	Monogram Systems

AVIONICS: Honeywell flight management system, with Thales/Diehl displays; Rockwell Collins com/nav standard (includes VHF 920 and HF 900 data radios, multimode receiver, VOR 900 omnirange/marker beacon receiver, DME-900 and ADF-900), Elta ADT 406 ELT, Honeywell RDR-4000 colour weather radar, Dual Thales HUDs optional. Larger, more interactive displays and extended integrated modular avionics corrected by ethernet datalink. Cockpit layout, by Airbus Toulouse division, compatible with other Airbus family members.

Eight new-generation 15 × 20 cm (6 × 8 in) LCDs form centre of package. Pilots can modify objects such as performance and navigation objects inside the screens using a cursor. The cursor is controlled by a new addition to the cockpit – a fixed, wireless, trackball integrated into the pedestal. Cursor control has been made possible by moving away from an 'MS-DOS-like' systems environment to a modern user-friendly 'Windows-like' system in the A380, using a cursor to control and command.

New features specific to the displays include a split-screen feature on the navigation screen. In addition to the conventional horizontal graphic display there is an additional vertical view, from which pilots can see a cut along the trajectory of the aircraft containing all data relevant to the vertical trajectory, such as safety altitudes, terrain, weather or vertical flight plan.



A380 second prototype MSN004 wearing the livery of second customer Emirates during its airport compatibility tour in late 2005

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A380 MAJOR AIRFRAME INDUSTRIAL PARTNERS

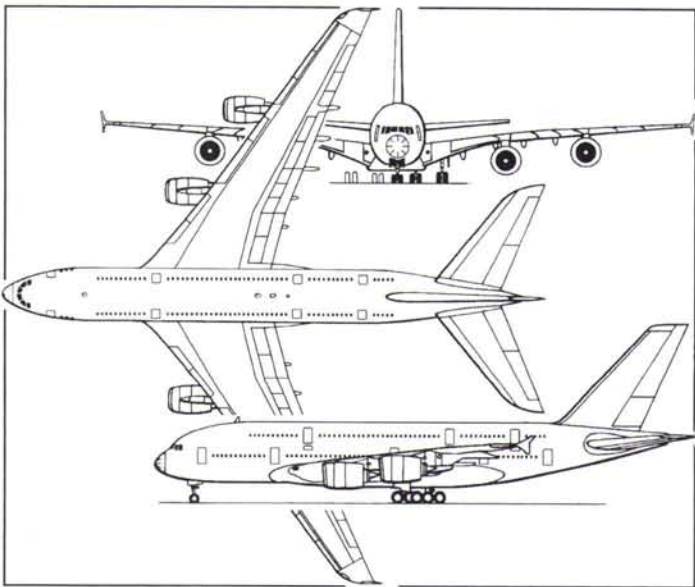
Country	Company	Item
Australia	Hawker de Havilland	Wingtip fences
Austria	Fischer Advanced Composites	Flap track fairings; CFRP window frames; other components
Belgium	Belaibus ¹	Wing slat tracks and droop noses
	Sabca ¹	Centre rear lower fuselage shell
Finland	Patria Finavicom ¹	Composites wing spoilers
France	EADS Socata ¹	Nose lower structure; nosewheel doors
	EADS Sogerma Services ¹	Centre rear main deck floor; flight deck seats
	Hurel-Hispano	Engine nacelles and thrust reversers
	Latécoère ¹	Upper deck passenger doors; lower nose section
	Mecachrome	Wing spars; upper and lower floor assemblies
	Messier-Dowty	Nose landing gear
	Michelin	Tyres
Germany	EADS Military Aircraft ¹	Wing inner inboard fixed leading-edges
	Eurocopter Deutschland ¹	Passenger and cargo doors
Italy	Alenia Aeronautica ¹	Centre upper and forward lower fuselage
Japan	Bridgestone	Tyres
	Fuji ¹	Vertical tail composites assemblies
	JAMCO	Upper floor deck crossbeams; vertical tail reinforcements
	Mitsubishi	Front and rear lower cargo doors
	Nippi ¹	Tailplane tips
	ShinMaywa	Wing root end fillet fairings
Korea, South	KAI	Wing bottom panels
Malaysia	CTRM ¹	Wing fixed leading-edge lower panels and inboard outer fixed leading-edges
Netherlands	Stork Aerospace ¹	Thermoplastic wing leading-edge 'J-noses'; selected forward and aft fuselage panels
Spain	Aries	Elevator and rudder components
	Gamesa ¹	Rear fuselage metal structures
	MASA	Tailplane leading/trailing-edges and ribs; wing ribs
	Sacasa	Belly fairing panels
Sweden	Saab Aerostructures ¹	Wing fixed leading-edge outboard of inner engine nacelles
Switzerland	RUAG Aerospace ¹	D-nose skins for wing inner fixed leading-edge and outer fixed trailing-edge
UK	BAE Systems Aerostructures ¹	Wing inboard outer fixed leading-edges
	Dunlop Aerospace	Nosewheels and brakes
	GKN Aerospace Services ¹	Wing fixed trailing-edge composites secondary structures; flap track beams
USA	Goodrich	Main landing gear
	Honeywell	Mainwheels and brakes
	Ralee Engineering	Wing top skin stringers

¹ Risk-sharing partner

Onboard information system (OIS) offers flight crews easy access to non-avionics-related information and applications. This includes access to flight manuals, maintenance tools, cabin log books, passenger lists and more. As the system uses web technology, information can be passed in real time from ground to air and vice-versa. The OIS also provides passengers with web-browsing facilities. Flight crew access the OIS from display units, integrated at either side of the instrument panel, using a keyboard installed in the folding table. Onboard maintenance system (OMS) provides real-time information to ground crew. Honeywell terrain guidance and on-ground navigation integrated into FMS.

DIMENSIONS. EXTERNAL:

Wing span	79.80 m (261 ft 9¾ in)
Wing chord: at root	17.70 m (58 ft 0¾ in)
mean aerodynamic	12.30 m (40 ft 4¼ in)
Wing aspect ratio	7.5
Length: overall	73.00 m (239 ft 6 in)
fuselage	70.40 m (230 ft 11¾ in)
Fuselage: Max width	7.14 m (23 ft 5 in)
Max height	8.41 m (27 ft 7 in)
Height overall	24.10 m (79 ft 0¾ in)
Fin chord: at root	12.05 m (39 ft 6½ in)
at tip	4.70 m (15 ft 5 in)
Tailplane span	30.37 m (99 ft 7¾ in)
Wheel track, max (wing gear outer rims)	14.335 m (47 ft 0¼ in)
Wheel track (c/l shock-absorbers): wing gear	12.455 m (40 ft 10¼ in)
fuselage gear	5.265 m (17 ft 3¼ in)
Wheelbase (c/l shock-absorbers): wing gear	33.58 m (110 ft 2 in)
fuselage gear	36.855 m (120 ft 11 in)
Distance between engine centres:	
inboard	29.60 m (97 ft 1¼ in)
outboard	51.40 m (168 ft 7½ in)
Passenger doors (16, each): Height	1.93 m (6 ft 4 in)
Width	1.07 m (3 ft 6¼ in)
Height to sill: upper forward	7.85 m (25 ft 9 in)
upper centre	7.90 m (25 ft 11 in)
upper rear	7.92 m (25 ft 11¾ in)
main front	5.07 m (16 ft 7½ in)
main No. 2	5.09 m (16 ft 8½ in)
main No. 3 (emergency)	5.13 m (16 ft 10 in)
main No. 4	5.16 m (16 ft 11¼ in)
main No. 5	5.18 m (17 ft 0 in)
Upper deck cargo door (A380-800F, port):	
Max width	3.68 m (12 ft 1 in)
Max height	2.23 m (7 ft 3¾ in)
Height to sill	7.93 m (26 ft 0¼ in)
Main deck cargo door (A380-800F, port):	
Max width	4.27 m (14 ft 0 in)
Max height	2.61 m (8 ft 6¾ in)
Height to sill	5.15 m (16 ft 10¾ in)
Forward cargo hold door (stbd):	
Max width	2.79 m (9 ft 1¾ in)
Max height	1.80 m (5 ft 10¾ in)
Height to sill: A380	3.02 m (9 ft 11 in)
A380F	3.05 m (10 ft 0 in)
Rear cargo hold door (stbd):	
Max width	3.10 m (10 ft 2 in)



Airbus A380-800 555-seat airliner (James Goulding)

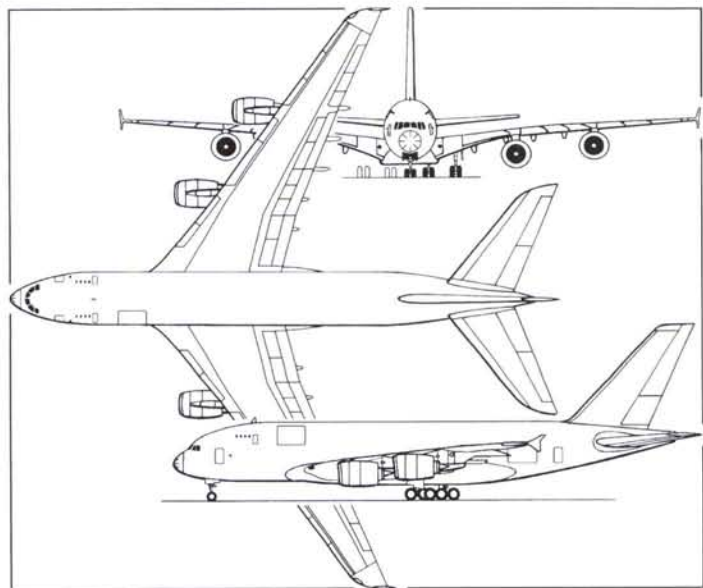
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Max height	1.80 m (5 ft 10¾ in)
Height to sill: A380	3.12 m (10 ft 2¾ in)
A380F	3.14 m (10 ft 3½ in)
Bulk cargo door (stbd):	
Max width	1.13 m (3 ft 8½ in)
Max height	0.90 m (2 ft 11½ in)
Crew door (A380F): as A380 passenger	
Height to sill	5.03 m (16 ft 6 in)
Crew rest emergency exit (A380F):	
Height to sill	7.80 m (25 ft 7 in)
Clearance beneath engines at max ramp weight:	
inboard	1.03 m (3 ft 4½ in)
outboard	1.88 m (6 ft 2 in)
Pilot's eye above ground level	7.09 m (23 ft 3¼ in)
DIMENSIONS. INTERNAL:	
Cabin, A380-800: Length	50.68 m (166 ft 3¼ in)
Max width: main deck	6.58 m (21 ft 7 in)
upper deck	5.92 m (19 ft 5 in)
Width at floor: main deck	6.20 m (20 ft 4 in)
upper deck	5.33 m (17 ft 6 in)
Cargo volume, usable (container/pallet):	
lower deck: forward	90.0 m³ (3,178 cu ft)
aft	72.0 m³ (2,543 cu ft)



Airbus A330 simulating its aerial tanker counterpart with assistance from two Panavia Tornados (Paul Jackson)

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Airbus A380F freighter (James Goulding)

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bulk: A380-800	14.3 m ³ (505 cu ft)
A380-800F	18.4 m ³ (650 cu ft)
main deck (A380-800F)	508.0 m ³ (17,940 cu ft)
upper deck (A380-800F)	250.0 m ³ (8,829 cu ft)
Total volume (containers + bulk):	
A380-800	171.0 m ³ (6,039 cu ft)
A380-800F	up to 1,134 m ³ (40,047 cu ft)
AREAS:	
Wings, gross	845.0 m ² (9,095.5 sq ft)
Fin	122.3 m ² (1,316.4 sq ft)
WEIGHTS AND LOADINGS:	
Typical operating weight empty:	
A380-841	270,015 kg (595,275 lb)
A380-861	270,281 kg (595,875 lb)
A380-843F	250,560 kg (552,400 lb)
A380-863F	250,826 kg (552,975 lb)
Max payload: A380-841	90,985 kg (200,575 lb)
A380-861	90,720 kg (200,000 lb)
A380-843F	151,440 kg (333,875 lb)
A380-863F	151,175 kg (333,275 lb)
Max fuel weight: standard	247,502 kg (545,650 lb)
optional	284,108 kg (626,350 lb)
Max T-O weight: A380-800	560,000 kg (1,234,575 lb)
A380-800F, basic	590,000 kg (1,300,725 lb)
A380-800F, optional	600,000 kg (1,322,775 lb)
Max ramp weight: A380-800	562,000 kg (1,239,000 lb)
A380-800F, basic	592,000 kg (1,305,150 lb)
Max landing weight:	
A380-800, basic	386,000 kg (850,975 lb)
A380-800F	427,000 kg (941,375 lb)
Max zero-fuel weight:	
A380-800	361,000 kg (795,875 lb)
A380-800F, basic	402,000 kg (886,250 lb)
A380-800F, optional	379,000 kg (835,550 lb)
Max wing loading:	
A380-800	662.7 kg/m ² (135.74 lb/sq ft)
A380-800F	698.2 kg/m ² (143.01 lb/sq ft)
Max power loading:	
A380-800	463 kg/kN (4.54 lb/lb st)
A380-800F	433 kg/kN (4.25 lb/lb st)
PERFORMANCE (estimated, GP7200 series engines except where indicated):	
Max operating speed	M0.89 (340 kt; 630 km/h; 391 mph)
Econ cruising Mach No.	0.82
Approach speed	141 kt (261 km/h; 162 mph)
Initial cruising altitude	10,670 m (35,000 ft)
Service ceiling	13,100 m (42,980 ft)

T-O field length, ISA + 15°C:	
A380-800, Trent 970	2,987 m (9,800 ft)
A380-800, GP7270	3,030 m (9,940 ft)
A380-800F	3,009 m (9,870 ft)
Landing field length at MLW, ISA + 15°C:	
A380-800	2,103 m (6,900 ft)
Runway ACN	approx 68
Time from brake release to FL330:	
A380-800, Trent 970	23 min
A380-800, GP7270	25 min
A380-800F, Trent 977	26 min
A380-800F, GP7277	28 min
Range:	
A380-800 with 555 passengers	8,000 n miles (14,816 km; 9,206 miles)
A380-800F: basic, with 150 t payload	5,600 n miles (10,371 km; 6,444 miles)
extended range mode, with 127 t payload	6,900 n miles (12,778 km; 7,940 miles)
OPERATIONAL NOISE LEVELS: Designed to have a 12 EPNdB cumulative margin to ICAO Stage 4 noise limits; also complies with London airports' 'Quota Count 2' category for departures (3 dB quieter than, or half the noise energy level of, most in-service Boeing 747s)	

AIRBUS MULTIROLE TANKER-TRANSPORT (MRTT)

TYPE: Tanker-transport.

PROGRAMME: Belgian, Canadian, French, German and Thai air forces already operate A310s variously fitted for VIP, troop and/or freight transport. Airbus has delegated development and marketing of flight refuelling versions to its major partners, using either pre-owned or new aircraft. Demonstrator MRTT produced by conversion of former airline A310-324 N816PA; undertook compatibility trials with RAF aircraft, July 1995. Marketing efforts originally centred on the A310 version, which was offered for the RAF's FSTA (future strategic tanker aircraft) requirement, only to be replaced by fresh proposal based on A330.

Four Luftwaffe A310-300s being converted into dual-point MRTTs, first of which (1027) flew 20 December 2003. Canada is having two CC-150 Polaris MRTs converted into MRTTs in same programme. Modification involves installation of Flight Refuelling Mk 32-900 HDUs beneath wings plus associated plumbing and operator equipment on flight deck.

A330-200 being developed as strategic tanker/transport and was chosen by the AirTanker consortium as most suitable platform for UK FSTA programme. Consortium members EADS, Rolls-Royce, Thales and FRA conceived a private finance initiative (PFI) solution with service entry in 2008 and programme life of 27 years; AirTanker bid selected on 26 January 2004 and is expected to involve a mix of about 16 new-build and second-hand A330-200s powered by Rolls-Royce Trent 772B engines; at same time, it was revealed that several key aspects of PFI solution must still be resolved before formal signature of contract. By early 2005, these difficulties still not overcome, although AirTanker optimistic of securing contract signature in early 2006.

A330-based tanker also offered to Australia for AIR 5402 requirement for up to five aircraft; tenders submitted by Airbus and rival Boeing in October 2003; Airbus contender selected, with announcement on 16 April 2004 confirming that five A330-203MRTT aircraft would be delivered in 2008-11; formal signature of contract took place 20 December 2004. First aircraft to undergo tanker modification by EADS CASA from May 2006; remaining four will be converted in Australia by Qantas Defence in partnership with Australian Aerospace, ADI and GKN Aerospace, with Qantas also to provide lifetime support. In addition to tanker modifications, RAAF aircraft also to feature Northrop Grumman AN/AAQ-24 DIRCM, but will apparently not incorporate chaff/flare dispensers. Operating unit expected to be 33 Squadron at Richmond, with IOC in 2009.

Following collapse of plan to lease Boeing KC-767, US Air Force had to restart tanker procurement programme on competitive basis; Boeing expected to compete, with EADS planning to counter with variant of Airbus A330-200, initially known as KC-330, but since redesignated KC-30. EADS North America plans to build assembly centre in Mobile, Alabama, if successful in securing USAF contract; this could undertake assembly of up to 25 aircraft per year. EADS announced teaming agreement with Northrop Grumman on 7 September 2005 under which KC-30 would be assembled at Mobile and then transferred to separate Northrop Grumman facility for final modifications before delivery to USAF. As many as 400 aircraft of chosen type could be purchased over period of 20 years, with USAF now hopeful of selecting winner in 2007 and accepting initial four aircraft in FY10, with full-rate production to begin in FY12.

CURRENT VERSIONS: Interim MRT (MultiRole Transport) version of A310, without tanker capability, converted by Elbe Flugzeugwerke, Dresden and Lufthansa Technik, Hamburg, for Luftwaffe. Structural strengthening and 3.50 m x 2.50 m (11 ft 5 3/4 in x 8 ft 2 1/2 in) cargo door added in port forward fuselage. Capacity of up to 214 passengers; or 36 tonnes of cargo/passengers; or 56 stretchers and six intensive care patients in the casevac role. First redelivered from Dresden in June 1999; four of seven Luftwaffe A310s returned to service as MRTs by early 2002. Luftwaffe aircraft proved partially incompatible with military cargo handling equipment and upper deck therefore rarely used for freight; full conversion of two MRTs to MRTT, plus conversion of further pair of standard aircraft directly to MRTT, being undertaken between 2002 and 2005; first tanker kit delivered by EADS CASA in November 2002, with first flight following modification on 20 December 2003. Initial two



Artist's impression of USAF KC-30

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aircraft modified at Dresden and handed over to German and Canadian forces in joint delivery ceremony on 29 September 2004. Remaining Luftwaffe A310s comprise two in VIP configuration and one passenger transport.

DESIGN FEATURES: Conversions offer greater refuelling and transport capability than earlier airliners in combination with modern aircraft with better lifetime costs and longer life expectancy. Possible roles include tanker with underwing HDUs and fuselage-mounted boom and/or hose transfer systems and carrying in excess of 111,270 kg (245,300 lb) of fuel (139,060 litres; 36,737 US gallons; 30,590 Imp gallons); and cargo and personnel transports which can be combined with refuelling, medevac, airborne command post and reconnaissance/airborne warning.

EADS has completed design of new advanced refuelling boom system (ARBS) which was expected to begin 300 to 400 hours of flight trials on an Airbus A310-304 in late 2005; this aircraft was rolled out at Getafe, Spain on 23 December 2005, following modification by EADS CASA. ARBS will thereafter be adapted for use by A330 and is to be installed on Australian aircraft, which will also have two Mk 32-905E HDUs. Maximum boom fuel flow rate is to be 4,550 litres, (1,200 US gallons; 1,000 Imp gallons) per minute. Retracted length of ARBS is 10.85 m (35 ft 7 in); extended length is 17.63 m (57 ft 10 in). Approximate weight of ARBS is 1,202 kg (2,650 lb).

Airbus conversions offer payloads from 35,000 to 50,000 kg (77,161 to 110,231 lb), full payload transatlantic range, long on-station time, combined boom and hoses reel transfer capability (fuel transfer rate at each refuelling point of 1,590 litres (420 US gallons; 350 Imp gallons) per minute), standard Airbus forward port-side freight door (projected height 2.57 m; 8 ft 5¼ in; width 3.58 m; 11 ft 9 in); quick-change main deck layout, probe or receptacle fuel receiver capability; commonality with existing airliners and same worldwide support resources, predictable spares requirements and longer remaining airframe life.

About 100 civil operators fly A300/310, and first-generation Airbus airliners now available on second-hand market; military rendezvous and self-protection systems can be fitted; main deck can be converted with palletised seating for up to 272 passengers in under 24 hours; up to 28,000 kg (61,729 lb) of additional fuel can be carried in tanks in underfloor cargo compartments.

DIMENSIONS, EXTERNAL (310: A310-300 MRTT, 330: A330-200 MRTT):	
Length overall, incl probe: 310	47.36 m (155 ft 4½ in)
330	59.69 m (195 ft 10 in)
DIMENSIONS, INTERNAL:	
Usable cabin length: 310	43.90 m (144 ft 0 in)
330	45.00 m (147 ft 7¾ in)
Cabin height: both	2.28 m (7 ft 5¼ in)
Max cabin width: both	5.29 m (17 ft 4¼ in)
Underfloor freight hold volume:	
310	80.0 m ³ (2,825 cu ft)
330	136.0 m ³ (4,803 cu ft)
WEIGHTS AND LOADINGS:	
Operating weight empty:	
310	80,830 kg (178,200 lb)
330	120,500 kg (265,650 lb)
Max non-fuel payload: 310	37,000 kg (81,571 lb)
330	61,300 kg (135,140 lb)
Max normal fuel capacity:	
310	47,940 kg (105,690 lb)
330	111,270 kg (245,300 lb)
Additional fuel: 310	28,240 kg (62,258 lb)

Max T-O weight:	
normal, 310	157,000 kg (346,125 lb)
330	230,000 kg (507,075 lb)
optional, 310	164,000 kg (361,550 lb)
330	233,000 kg (513,675 lb)
Max ramp weight: 310	164,900 kg (363,550 lb)
330	233,900 kg (515,650 lb)
Max landing weight: 310	124,000 kg (273,375 lb)
330	182,000 kg (401,250 lb)
Max zero-fuel weight: 310	114,000 kg (251,325 lb)
330	170,000 kg (374,775 lb)

PERFORMANCE:	
Refuelling speed:	
both, boom	240–320 kt (444–592 km/h; 276–368 mph)
both, hose and drogue:	
S/L to FL275	200–325 kt (370–602 km/h; 230–374 mph)
FL275 to FL350	M0.82
T-O run: 310	2,347 m (7,700 ft)
Max range, standard fuel:	
310	4,800 n miles (8,889 km; 5,523 miles)
Max range, using transferable fuel:	
310	7,200 n miles (13,334 km; 8,285 miles)
330	9,000 n miles (16,668 km; 10,357 miles)

AIRBUS AEW&C

TYPE: Airborne early warning and control system.
PROGRAMME: A310 originally selected by Raytheon Systems as airborne platform in unsuccessful bid for the Australian Project Wedgetail AEW&C requirement in which it competed against Boeing 737 and Lockheed Martin C-130J. Featured Elta Phalcon 360° phased-array radar in a fixed dorsal dome; formally announced in January 1997. Australia



Airbus A310 AEW&C proposal with non-rotating Elta radar above rear fuselage (Paul Jackson)

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selected Boeing 737 in July 1999, but A310 AEW&C also offered to Turkey (again unsuccessfully) and South Korea, which was originally due to select E-X platform shortly before the end of 2004 and award contract for four aircraft in 2005. Programme delayed by one year, resulting in relaunch in June 2005 for unspecified number of aircraft. At that time, proposals expected from Boeing and IAI/Elta Systems in addition to two contenders based on Airbus aircraft platform, specifically the A320 (Thales) and A321 (L-3 Communications). Total acquisition cost expected to be around USD2 billion.

AIRBUS A321 AGS

TYPE: Airborne ground surveillance system.

PROGRAMME: Northrop Grumman chose the A321 as its preferred Joint STARS platform to compete for NATO's AGS (airborne ground surveillance) requirement. Considered in 1996 and rejected on cost grounds, the A321 was reconsidered in the light of NATO's unwillingness to accept a Boeing 707-based solution. Plans called for selection in 2002 and IOC, with six aircraft, by 2007, but implementation delayed by US refusal to release all technology. Northrop Grumman's original AGS proposal featured the US Army's AN/APY-X RTIP (Radar Technology Insertion Program) with an electronically scanned antenna array, giving spot/swath SAR, wide area MTI, ultra-high resolution SAR, inverse SAR and long-range high-resolution MTI modes. However, concerns over technology

transfer resulted in substitution of TCAR (transatlantic co-operative AGS radar) as prime sensor, this being the result of blending US and European expertise and technology. The definitive AGS will have 10 to 12 operator stations.

By 2002, Northrop Grumman, EADS and Galileo Avionica had teamed up to promote TIPS (Transatlantic Industrial Proposed Solution; www.tips-ags.com), which is based on A321 airframe and will involve participation of wide range of subcontractors throughout NATO countries. General Dynamics Canada, Indra and Thales had joined industrial team by 9 January 2004, when operating proposal submitted to NATO. National Armament Directors' conference approved proposal on 16 April 2004 (rejecting rival Raytheon bid) with intention of awarding contract in second quarter of 2005; however, on 28 April 2005, EUR23 million project definition study contract signed, with EUR500 million design and development contract then expected to follow in early 2006. Contract for EMD phase should follow at the end of 2008, with acquisition phase beginning in mid-2010. At this time, NATO considering initial fleet of five A321 manned platforms and seven Global Hawk UAVs. By 2004, AGS envisaged with A321 "almost certainly" having sensor raised above rear fuselage (in "topknot" position) and Northrop Grumman RQ-4B Global Hawk UAVs as 'gap-fillers'. IOC anticipated in last quarter of 2010, with four aircraft and 18 ground stations to provide minimum single-orbit coverage. Full requirement may be 12 and 48, respectively, although six and 24 would ensure two simultaneous missions.



'Topknot' radar installation on Airbus A321 AGS

1151728

AIRTECH

AIRCRAFT TECHNOLOGY INDUSTRIES

PARTICIPATING COMPANIES

EADS CASA: (Spain)
Dirgantara: (Indonesia)

Airtech was formed by CASA (now part of EADS) and IPTN (now known as Dirgantara) to develop the CN-235 twin-turboprop transport; responsibility for design and production was shared equally between the two companies. The partnership applied only to the Series 10 and Series 100/110, with later versions being developed independently by CASA, according to a statement by that company.

AIRTECH CN-235

Spanish Air Force designations: T.19A and T.19B

TYPE: Twin-turboprop transport; maritime surveillance twin-turboprop.

PROGRAMME:

DEVELOPMENT MILESTONES

Design began	Jan 1980
First prototype material cut	May 1981
Rolled out	10 Sep 1983
First flight	11 Nov 1983
Certification	20 Jun 1986
First flight, production	19 Aug 1986
First delivery (Merpati)	15 Dec 1986
Entered service (Merpati)	1 Mar 1988

Launched as joint venture between CASA and Indonesian manufacturer IPTN (now Dirgantara, which see), which formed Airtech company to manage programme. Series 10 and Series 100/110 versions covered by this agreement; subsequent versions, notwithstanding Indonesian Series 220 and 330 equivalents, stated by CASA to be wholly Spanish.

Preliminary design began January 1980, prototype construction May 1981; one prototype completed in each country, with simultaneous roll-outs 10 September 1983; first flights 11 November 1983 (by CASA's ECT-100) and 30 December 1983 (IPTN's PK-XNC); Spanish and Indonesian certification 20 June 1986; first flight of production aircraft 19 August 1986; FAA type approval (FAR Pts 25 and 121) 3 December 1986; deliveries began 15 December 1986 from IPTN line and 4 February 1987 from CASA; entered service (with Merpati Nusantara Airlines) 1 March 1988; JAR 25 type approval October 1993.

Licence agreement with TAI (see Turkish section) announced January 1990, initially to assemble and later to manufacture locally 50 of 52 ordered; first flight of Turkish-assembled

aircraft 24 September 1992; first delivery 13 November 1992; final air force delivery 10 August 1998, but TAI subsequently produced follow-on batch of nine maritime patrol variants and may build further 10 for maritime missions.

In 1995, CASA unilaterally launched development of a stretched CN-235, as C-295; this is described under CASA heading in Spanish section.

CURRENT VERSIONS: **CN-235 Series 10:** Initial production version (15 built by each company), with CT7-7A engines.

CN-235 Series 100/110: Generally as Series 10, but CT7-9C engines in new composites nacelles; replaced Series 10 in 1988 from 31st production aircraft. Series 100 is Spanish-built and, following JAA certification, was certified by FAA in February 1992. Series 110 is Indonesian-built, with improved electrical, warning and environmental systems to comply with JAR 25; certification of this version achieved in Europe (JAA), July 1995.

Detailed description applies to the above version except where indicated.

CN-235 Series 200/220: Structural reinforcements to cater for higher operating weights, aerodynamic improvements to wing leading-edges and rudder, reduced field length requirements and much-increased range with maximum payload; Series 200 is Spanish-built and was certified by FAA March 1992. Series 220 is Indonesian-built, with improvements similar to Srs 110; prototype, flown early 1996, is converted from a company development aircraft (PK-XNV, the 20th production aircraft from the Indonesian line); orders include eight for Malaysian Air Force, of which six completed to Srs 220 standard (including three for maritime patrol) by early 1998 (34th to 39th Indonesian-built), with remaining two to be completed in VIP configuration. Revised leading-edge shape led to requirement to requalify pneumatic de-icer boots, delaying initial deliveries. Further orders for Series 220 from South Korea (eight, including one for VIP use and one for VVIP use) and Pakistan (four, including one for VIP use).

CN-235 Series 300/330: IPTN originally offered Series 330 **Phoenix** (with new Honeywell avionics, ARL-2002 EW system and 16,800 kg; 37,037 lb MTOW) to Royal Australian Air Force to meet Project Air 5190 tactical airlift requirement, but was forced by financial constraints to withdraw in 1998. Separately, CASA offered its own Series 300 to meet the same specification.

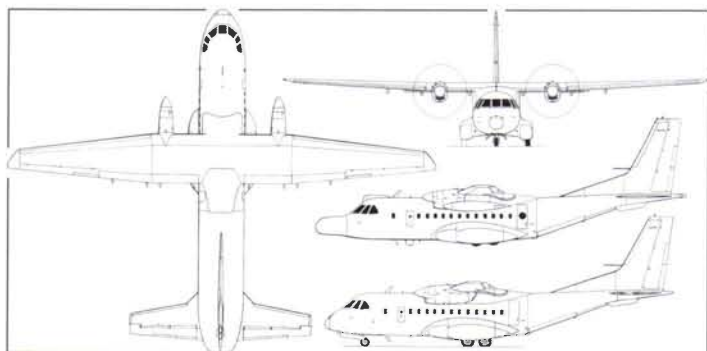
CN-235 Series 300 under certification in 2000 with an open-systems avionics architecture, based on MIL-STD-1553B and ARINC 429 digital databusses. Full NVG-compatible cockpit; four-dimensional navigation system with avionics suite, including Thales (Sextant) Topdeck colour weather radar, radios, solid-state flight data and cockpit voice recorders, enhanced TCAS, enhanced GPWS and four 152 × 203 mm (6 × 8 in) LCDs; twin HUDs and Totem 3000 ring laser gyro INS optional. Other features include in-flight refuelling capability, improved pressurisation (2,440 m; 8,000 ft cabin environment at 7,620 m; 25,000 ft) and provision for optional twin nosewheel installation to provide better soft-field taxiing capability.

CN-235 AEW: Proposals were revealed in December 1995 for fitment of an Ericsson Erieye electronically scanned phased-array radar above the fuselage of a CN-235. Initial interest was from the Indonesian Air Force, but primarily in the ocean surveillance role;



Colombian Air Force CN-235s

0587695



CASA CN-235 twin-turboprop multipurpose transport, with additional side view (centre) of a representative CN-235 MPA (Dennis Punnett)

0507150

refit of three existing aircraft was considered, but has not been undertaken. Radar, three surveillance operators' positions and associated equipment increase aircraft weight by approximately 2,000 kg (4,409 lb). No recent news of this proposal has been received.

CN-235ER: Extended-range version (based on Series 300) originally selected by US Coast Guard in 2002 as fixed wing element of Project Deepwater re-equipment programme, but subsequently shelved in favour of the basic CN-235 Series 300M MPA, described separately.

CN-235 M: Other military transport versions.

CN-235 MP Persuader: Maritime patrol and surveillance versions. CN-235 MP Persuader is CASA version. In service with Irish Air Corps (two) and Turkey (nine: six for Navy, three for Coast Guard, assembled by TAI at Ankara). In mid-1999, Turkey sought proposals from at least seven potential integrators of surveillance systems to provide radar, FLIR and an acoustics suite for naval CN-235s; on 6 September 2002, contract signed with Thales covering supply and integration of maritime patrol mission equipment by 2006. Contract worth US\$350 million and could be followed by further 10 systems to equip additional batch of aircraft.

CN-235 Series 300M MRS MPA (Medium Range Surveillance Maritime Patrol Aircraft): CASA version for US Coast Guard, which ordered initial two and took option on further six of anticipated 35 HC 235 aircraft in FY03 budget at cost of US\$87.4 million. Delivery expected in 2006 and will feature EADS CASA Fully Integrated Tactical System (FITS), including multimode search radar, EO/IR sensors, VHF, UHF and HF communications, SATCOM terminal and large observation windows. Entire tactical system will be palletised, allowing aircraft to be easily reconfigured for use as personnel and/or cargo transport.

CN-235 MPA: Indonesian-developed version; available either with lengthened nose housing radar and IFF; or with normal CN-235 nose, plus belly radar. CN-235 prototype PK-XNC served as testbed. Maximum T-O weight 15,400 kg (33,951 lb), endurance more than 8 hours. Provision for quick-change configuration for general transport, communications or other duties.

Indonesia confirmed initial three firm orders (of planned six aircraft) in May 2000, when Thomson-CSF (now Thales) selected to supply AMASCOS airborne maritime situation control system, comprising Elettronica ALR-733 RWR, TCSF Ghio thermal imager and Sextant Gemini navigation computer. At least one aircraft used as testbed in 2002. In early

2004, Thales systems reportedly being installed on three aircraft, with Thales anticipating sale of further three systems to Indonesia by mid 2004. Brunei chose Boeing as Argo Systems integrator for its three aircraft in late 1995, specifying individual sensors in October 1996 as AN/AAQ-21 FLIR, BAE Sky Guardian ESM, Cossor 3500 IFF and AN/APS-134 radar, plus two operators' consoles. Five surveillance aircraft for Indonesia Navy were under construction in early 2005, Brunei also planning to acquire three, but these yet to appear.

CN-235 QC: Quick-change cargo/passenger version; certified by Spanish DGAC May 1992.

CN-245: Indonesian stretched version; not built.

C-295: Spanish stretched version; described separately under CASA heading.

N2XXM: Project abandoned.

CUSTOMERS: Refer to table. By 1 January 2005 CASA had delivered 163 and Dirgantara 55, for a total of 218. Further 10 then under construction at Dirgantara and two awaiting customers at CASA.

One (sn 66049) acquired (presumably second-hand) by USAF Special Operations Command in 1998. Turkey signed a lease agreement on 16 April 1999 to allow a one-year renewable lease of two Turkish Air Force CN-235s to Jordan. Three Merpati aircraft leased to Air Venezuela from May 1999; three leased to Asian Spirit Airlines, Philippines, from March 2000, including two on lease-purchase. One CN-235-300 (first of this subvariant in service) leased by Austrian Ministry of Defence for six months from April 2000. CN-235 is contender in Taiwanese Air Force requirement for 18 light transports, and for the US Army Airborne Common Sensor platform requirement. Winner of US Coast Guard Project Deepwater competition, with 35 aircraft initially expected to be acquired, although total number could decrease to no more than 20.

CN-235 also in contention for US Army FCA (Future Cargo Aircraft) programme, in conjunction with C-295; Army has initial requirement for 33 aircraft to replace Shorts C-23B and expects to award contract in January 2007.

COSTS: USD17.1 million (2002) programme unit cost, Malaysia.

DESIGN FEATURES: Optimised for short haul operations, enabling it to fly four 860 n mile (1,593 km; 990 mile) stage lengths (with reserves) before refuelling and to operate from paved runways or unprepared strips; high-mounted wing; pressurised fuselage (including baggage compartment) of flattened circular cross-section, with upswept rear end incorporating cargo ramp/door; sweptback fin (with dorsal fin) and rudder; low-set non-swept fixed incidence tailplane and elevators; two small ventral fins; vortex generators on rudder and elevator leading edges; optional extended nose radome.

NACA 65₄ 218 aerofoil with no dihedral/constant chord centre-section; tapered outer panels have 3° dihedral and 3° 51' 36" sweepback at quarter-chord.

FLYING CONTROLS: Conventional and manual. Ailerons, elevators and rudder statically and dynamically balanced (duplicated actuation for ailerons); mechanical servo tab and electric trim tab in each aileron, rudder and starboard elevator, trim tab only in port elevator; single-slotted inboard and outboard trailing-edge flaps (each pair interchangeable port/starboard), actuated hydraulically by Dowty irreversible jacks.

STRUCTURE: Conventional semi-monocoque, mainly of aluminium alloys with chemically milled skins, composites (mainly glass fibre or glass fibre/Nomex honeycomb sandwich, with some carbon fibre and Kevlar) for leading/trailing-edges of wing/tail moving surfaces, wing/fuselage and main landing gear fairings, wing/fin/tailplane tips, engine nacelles, ventral fins and nose radome. Propeller blades are of glass fibre, with metal spar and urethane foam core.

CASA builds wing centre-section, inboard flaps, forward and centre fuselage, engine nacelles; Dirgantara builds outer wings, outboard flaps, ailerons, rear fuselage and tail unit; both manufacturers use numerical control machinery extensively. Final assembly line in



Maritime surveillance CN-235 MP Persuader of the Irish Air Corps (Paul Jackson)

0569649

CN-235 PRODUCTION
 (at 1 January 2005)

Customer	Qty	Series	First order	First aircraft	First delivery	Delivered	Mfr
Civil version:							
Binter Canarias (Spain)	4 ²	10	10 Jun 88	EC-EMO	22 Dec 88	4	CASA
Binter Mediterraneo (Spain)	5	100 ¹	19 Dec 89	EC-FAD	4 Sep 90	5	CASA
Mandala Airlines (Indonesia)	3	110					Dirgantara
Merpati Nusantara (Indonesia)	15	10		PK-MNA	15 Dec 86	15	Dirgantara
Devon Holding & Leasing ¹² (USA)	4	300	2002	N168D	2002	4	CASA
Military version:							
Abu Dhabi Air Force	7	110		810	31 Aug 93	7	Dirgantara
Botswana Defence Force	2	10	10 Jun 86	OG-1	21 Dec 87	2	CASA
Brunei Air Wing	3	MPA					Dirgantara
	1	110		ATU-501	1997	1	Dirgantara
Chilean Army	3	100	12 Feb 89	E-216	31 Aug 89	3	CASA
Colombian Air Force	3	200	Jul 97	1260	28 Jan 98	3	CASA
Ecuadorian Army	1	100	6 Jun 89	AEE-502	6 Jun 89	1	CASA
	1	300		AEE-503	12 Jan 05	1	CASA
Ecuadorian Navy	1	100	27 Jul 88	ANE-204	13 Jun 89	1	CASA
French Air Force	15 ³	200	11 Apr 90	043	28 Feb 91	15	CASA
	5	200	2002	152	2002	5	CASA
Gabon Air Forces	1	100	26 Feb 90	TR-KJE	19 Mar 91	1	CASA
Indonesian armed forces	24 ⁴	110		A-2301	12 Jan 93	7	Dirgantara
Irish Air Corps	1 ⁵	100	3 Apr 91	250	10 Apr 91	1	CASA
	2	MP	3 Apr 91	252	8 Dec 94	2	CASA
Malaysian Air Force	8 ⁶	220		M44-01	26 Aug 99	7	Dirgantara
Moroccan Air Force	7 ⁷	100	19 Sep 89	CNA-MA	27 Sep 90	7	CASA
Oman Police	2	100	15 Feb 92	A40-CU	14 Jan 93	2	CASA
Pakistan Air Force	4	220	29 Jun 01	04-043	28 Jan 04	4	Dirgantara
Panama National Guard	1 ⁸	10	19 Mar 87	SAN-265	13 Sep 88	1	CASA
Papua New Guinea Defence Force	2	100	26 Oct 91	P2-0501	15 Nov 91	2	CASA
Saudi Air Force	4	10	5 Feb 84	118	9 Feb 87	4	CASA
South African Air Force							
(ex-Bophuthatswana Air Force)	1	10	29 May 90	8026	6 Jan 91	1	CASA
South Korean Air Force ¹³	12	100	19 Aug 92	078	13 Nov 93	12	CASA
	8	220	21 Oct 97	044	18 Dec 01	8	Dirgantara
Spanish Air Force	2 ⁹	10	16 Nov 88	T.19-01	7 Dec 88	2	CASA
	18	100	28 Dec 90	T.19-03	1 Feb 91	18	CASA
Thai Ministry of Agriculture and Co-operatives	2	220	Oct 96	2221	Apr 99	2	Dirgantara
Turkish Air Force	52 ¹⁰	100	11 Dec 90	051	25 Jan 92	52	TAI/CASA
Turkish Navy	6	MP	23 Sep 98	TCB-651	23 Dec 01	6	TAI/CASA
Turkish Coast Guard	3	MP	23 Sep 98	TCSG-551	23 Dec 01	3	TAI/CASA
US Coast Guard	2	MP	20 Feb 04		2006		CASA
Venezuela	2	MP	30 Mar 05				CASA
Subtotals	237					209	
Demo/trials	5 ¹¹	(various)		EC-016		5	CASA
	5	(various)		PK-XNT		5	Dirgantara
Prototype	1	-		PK-XNC		1	Dirgantara
Crashed on test	1	MP		TCSG-552 (No.1)		1	TAI/CASA
Totals	249					221	

¹ Converted from Series 100 to Series 200² Withdrawn 1998; three to Luftmeister, South Africa; one to Turkish Army (lost 16 May 2001)³ Including option on seven taken up in February 1996; first eight as Srs 100, but upgraded to Srs 200 from 1999⁴ Includes five Navy and three Air Force aircraft under construction in January 2005⁵ Withdrawn at end of lease, 1995⁶ Including two VIP versions ordered in 2002 for 2005 delivery⁷ Includes one VIP version⁸ To Flight International (USA) 1995⁹ VIP version¹⁰ 50 built in Turkey by TAI¹¹ Includes one -100QC; plus one -200QC sold in 1996 to East Texas Aircraft Services Corporation¹² Appears to be a US government company¹³ South Korea considering acquisition of up to 30 Dirgantara-built aircraft in exchange for two submarines**Notes:** Operators of second-hand aircraft include Austral (Argentina), Colombian Navy and Thai Police

each country. Part of tail unit built by ENAER Chile under subcontract from CASA. TAI (Turkey) initially assembled under licence before progressing gradually to local manufacture.

LANDING GEAR: Messier-Bugatti retractable tricycle type with levered suspension, suitable for operation from semi-prepared runways. Electrically controlled hydraulic extension/retraction, with mechanical back-up for emergency extension. Oleo-pneumatic shock-absorber in each unit. Each main unit comprises two wheels in tandem, retracting rearward into fairing on side of fuselage. Mainwheels semi-exposed when retracted. Single steerable nosewheel ($\pm 48^\circ$) retracts forward into unpressurised bay under flight deck. Dunlop 28x9.00-12 (12 ply) tubeless mainwheel tyres standard, pressure 5.17 bar (75 lb/sq in) on civil version, 5.58 bar (81 lb/sq in) on military version; low-pressure mainwheel tyres optional, size 11.00-12 (10 ply), pressure 3.45 bar (50 lb/sq in). Dunlop 24x7.7 (10/12 ply) tubeless nosewheel tyre, pressure 5.65 bar (82 lb/sq in) on civil version, 6.07 bar (88 lb/sq in) on military version; optional 8.50x10 (12 ply). Dunlop hydraulic differential disc brakes; Dunlop anti-skid units on main gear. Chilean Army aircraft used in Antarctic have wheel/ski gear. Minimum ground turning radius 9.50 m (31 ft 2 in) about nosewheel, 18.98 m (62 ft 3/4 in) about wingtip.

POWER PLANT: Two General Electric CT7-9C turboprops (CT7-9C3 in Srs 300), each flat rated at 1,305 kW (1,750 shp) (S/L, to 41°C) for take-off and 1,394.5 kW (1,870 shp) up to 31°C with automatic power reserve. Hamilton Sundstrand 14RF-21 (14RF-37 in Srs 300) four-blade constant-speed propellers, with full feathering and reverse-pitch capability. Fuel in two 1,042 litre (275 US gallon; 229 Imp gallon) integral main tanks in wing centre-section and two 1,592 litre (421 US gallon; 350 Imp gallon) integral outer-wing auxiliary tanks; total fuel capacity 5,264 litres (1,391 US gallons; 1,158 Imp gallons), of which 5,128 litres (1,355 US gallons; 1,128 Imp gallons) are usable. Single pressure refuelling point in starboard main landing gear fairing; gravity filling point in top of each tank. Propeller braking permits starboard engine to be used as on-ground APU. Oil capacity 14 litres (3.7 US gallons; 3.1 Imp gallons).

ACCOMMODATION: Crew of two on flight deck, plus cabin attendant (civil version) or third crew member (military version). Accommodation in commuter version for up to 44 passengers in four-abreast seating, at 76 cm (30 in) pitch, with 22 seats each side of central aisle. Lavatory, galley and overhead luggage bins standard. Pressurised baggage compartment at rear of cabin, aft of movable bulkhead; additional stowage in rear ramp area and in overhead lockers. Can also be equipped as mixed passenger/cargo combi (for example, 19 passengers and two LD3 containers), or for all-cargo operation, with roller loading system, carrying four standard LD3 containers, five LD2s, or two 2.24 x 3.18 m (88 x 125 in) and one 2.24 x 2.03 m (88 x 80 in) pallets; or for military duties, carrying up to 57 fully equipped troops or 46 paratroops (51 troops or paratroops on Srs 300). Other options include layouts for aeromedical airlift (18 stretchers and two medical attendants on Srs 300), electronic warfare, geophysical survey or aerial photographic duties.

Main passenger door, outward- and forward-opening with integral stairs, aft of wing on port side, serving also as a Type I emergency exit. Type III emergency exit facing this door on starboard side. Crew/service downward-opening door (forward, starboard) has built-in stairs, and serves also as a Type I emergency exit, or as passenger door in combi version; second Type III exit opposite this door on port side. Wide ventral door/cargo ramp in underside of upswept rear fuselage, for loading of bulky cargo. Accommodation fully air conditioned and pressurised.

SYSTEMS: Hamilton Sundstrand air conditioning system, using engine compressor bleed air. Honeywell electropneumatic pressurisation system (maximum differential 0.25 bar; 3.6 lb/sq in) giving cabin environment of 2,440 m (8,000 ft) up to operating altitude of 5,480 m (18,000 ft) on Srs 200; Srs 300 cabin pressurisation increased to 0.38 bar (5.5 lb/sq in), giving cabin environment of 2,350 m (7,700 ft) at altitude of 7,620 m (25,000 ft). Hydraulic system, operating at nominal pressure of 207 bar (3,000 lb/sq in), comprises two engine-driven, variable displacement axial electric pumps, a self-pressurising standby mechanical pump, and a modular unit incorporating connectors, filters and valves; system is employed for actuation of wing flaps, landing gear extension/retraction, wheel brakes, emergency and parking brakes, nosewheel steering, cargo ramp and door, and propeller braking. Accumulator for back-up braking system.

28 V DC primary electrical system powered by two 400 A Auxilec engine-driven starter/generators, with two 24 V 37 Ah Ni/Cd batteries for engine starting and 30 minutes' (minimum) emergency power for essential services. Constant frequency single-phase AC power (115/26 V) provided at 400 Hz by three 600 VA static inverters (two for normal operation plus one standby); two three-phase engine-driven alternators for 115/200 V variable frequency AC power. Fixed oxygen installation for crew of three (single cylinder at 124 bar; 1,800 lb/sq in pressure); three portable units and individual masks for passengers.

Pneumatic boot anti-icing of wing (outboard of engine nacelles), fin and tailplane leading-edges. Electric anti-icing of propellers, engine air intakes, flight deck windscreen, pitot tubes and angle of attack indicators. Engine fire detection and extinguishing system.

AVIONICS (CIVIL): *Comms:* Two Rockwell Collins VHF-22B com radios, one Avtech DADS crew interphone, Rockwell Collins TDR-90 ATC transponder. Fairchild A-100A cockpit voice recorder, Avtech PACIS PA system. Dorne & Margolin ELT 8-1 emergency transmitter. Optional second TDR-90; optional HF-230 radio.

Radar: Rockwell Collins WXR-300 weather radar.

Flight: Two VIR-32 VOR/ILS/marker beacon receivers; DME-42; ADF-60A; two 332D-11T vertical gyros; two MCS-65 directional gyros; two ADI-85A; two HSI-85; two RMI-36; APS-65 autopilot/flight director; ALT-55B radio altimeter; two 345A-7 rate of turn sensors (all by Rockwell Collins); SFENA H-301 APM standby attitude director indicator; Hamilton Sundstrand Mk II GPWS; and Fairchild/Teledyne flight data recorder. Options include second DME-42 and ADF-60A, Rockwell Collins RNS-325 radar nav, Litton LTN-72R inertial nav or Global GNS-500A Omega navigation system.

Instrumentation: Rockwell Collins EFIS-85B five-tube CRT system standard.

AVIONICS (MILITARY) (INDONESIAN AIRCRAFT): *Comms:* Rockwell Collins AN/ARC-182 VHF/UHF; Rockwell Collins HF 9000 HF; IFF.

Flight: Rockwell Collins VIR-32 VHF nav; Litton LTN92 GPS-aided INS; Rockwell Collins DF-206A ADF; Rockwell Collins AN/APS-65F autopilot; GPWS.

Instrumentation: Rockwell Collins EFIS-85B(14) EFIS (four or five screens). IPTN developing cockpit lighting system compatible with night vision goggles.

AVIONICS (MILITARY): Series 300: Thales Avionics Topdeck suite (see Current Versions) as core system.

Flight: Twin ADU 3000 air data units, GPSs and AHRSS; radar altimeter; TCAS; GPWS; weather radar; optional Totem 3000 LINS, Cat. II landing capability, MLS and satcom.

Instrumentation: Four 152 x 203 mm (6 x 8 in) LCDs; optional HUDs. Optional electro-optical sensors display imagery on LCDs. NVG compatibility.

Mission: Four-dimensional navigation FMS calculates high-altitude and computed air release points for load-dropping.

AVIONICS (PERSUADER): *Radar:* Litton APS-504(V)5. US Coast Guard aircraft to have Telephonics AN/APS-143(V)3 surveillance radar.

Mission: FLIR-2000HP undernose-mounted night vision system and Litton AN/ALR-

85(V) ESM system, fully integrated via a central tactical processor with reconfigurable consoles. CAE AN/ASQ-508(V) MAD system selected for Turkish Navy and Coast Guard aircraft in late 2003.

AVIONICS (CN-235 MPA): *Radar:* BAE Systems Seaspray 4000 or Raytheon AN/APS-134 (LW) or Thales Ocean Master 100.

Flight: Litton LTN92 ring laser gyro INS; Trimble TNL 7900 Omega/GPS.

Mission: Argo data processing and display system with multifunction consoles. BAE Systems Sky Guardian SG-300, or Argo Systems AR-700 or Litton AN/ALR-93(V)4 ESM. FLIR Systems AN/AAQ-21 Safire or BAE Systems MRT FLIR. Cossor 3500 IFF interrogator. (Trials aircraft originally equipped with APS-504 and Ocean Master; SG-300. Reconfigured by 1994 with AN/APS-134, MRT, AR-700, LTN92 and TNL 7900. Further alternatives available at customer's option.)

Mission: Argo data processing and display system with multifunction consoles. BAE Systems Sky Guardian SG-300, or Argo Systems AR-700 or Litton AN/ALR-93(V)4 ESM. FLIR Systems AN/AAQ-21 Safire or BAE Systems MRT FLIR. Cossor 3500 IFF interrogator. (Trials aircraft originally equipped with APS-504 and Ocean Master; SG-300. Reconfigured by 1994 with AN/APS-134, MRT, AR-700, LTN92 and TNL 7900. Further alternatives available at customer's option.)

EQUIPMENT: Navigation lights, anti-collision strobe lights, 600 W landing light in front end of each main landing gear fairing, taxiing lights, ice inspection lights, emergency door lights, flight deck and flight deck emergency lights, cabin and baggage compartment lights, individual passenger reading lights, and instrument panel white lighting, all standard. Hand-type fire extinguishers on flight deck (one) and in passenger cabin (two); smoke detector in baggage compartment.

ARMAMENT (MILITARY VERSION): Three attachment points under each wing. Weapons can include AGM-84 Harpoon anti-ship missiles; Indonesian MPA version (which see) can be fitted with two Mk 46 torpedoes or AM 39 Exocet anti-shipping missiles.

Data follow for CASA-built Srs 300.

DIMENSIONS, EXTERNAL:

Wing span	25.81 m (84 ft 8 in)
Wing chord: at root	3.00 m (9 ft 10 in)
at tip	1.20 m (3 ft 11 1/4 in)
Wing aspect ratio	10.2
Length overall, standard nose	21.40 m (70 ft 2 1/2 in)
Fuselage: Max width	2.90 m (9 ft 6 in)
Max depth	2.615 m (8 ft 7 in)
Height overall	8.18 m (26 ft 10 in)
Tailplane span	10.60 m (34 ft 9 1/4 in)
Wheel track (c/l of mainwheels)	3.90 m (12 ft 9 1/2 in)
Wheelbase	6.92 m (22 ft 8 1/2 in)
Propeller diameter: Srs 200	3.35 m (11 ft 0 in)
Srs 300	3.66 m (12 ft 0 in)
Propeller ground clearance	1.66 m (5 ft 5 1/4 in)
Distance between propeller centres	7.00 m (22 ft 11 1/2 in)
Passenger door (port, rear) and service door (stbd, fwd): Height	1.70 m (5 ft 7 in)
Width	0.73 m (2 ft 4 1/4 in)
Height to sill	1.22 m (4 ft 0 in)
Paratroop doors (port and stbd, rear, each):	
Height	1.75 m (5 ft 9 in)
Width	0.90 m (2 ft 11 1/2 in)
Height to sill	1.22 m (4 ft 0 in)
Ventral upper door (rear): Length	2.365 m (7 ft 9 in)
Width	2.35 m (7 ft 8 1/2 in)
Height to sill	1.22 m (4 ft 0 in)
Ventral ramp/door (rear): Length	3.04 m (9 ft 11 3/4 in)
Width	2.35 m (7 ft 8 1/2 in)
Height to sill	1.22 m (4 ft 0 in)
Type III emergency exits (port, fwd, and stbd, rear):	
Height	0.92 m (3 ft 0 1/4 in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck: Length	9.65 m (31 ft 8 in)
Max width	2.70 m (8 ft 10 1/4 in)
Width at floor	2.365 m (7 ft 9 in)
Max height	1.90 m (6 ft 2 3/4 in)
Floor area	22.8 m ² (246 sq ft)
Volume	43.2 m ³ (1,527 cu ft)

AREAS:

Wings, gross	59.10 m ² (636.1 sq ft)
Ailerons (total, incl tabs)	3.14 m ² (33.80 sq ft)
Trailing-edge flaps (total)	10.87 m ² (117.00 sq ft)
Fin, incl dorsal fin	11.11 m ² (119.59 sq ft)
Rudder, incl tabs	4.20 m ² (45.21 sq ft)
Tailplane	21.20 m ² (228.2 sq ft)
Elevators (total, incl tabs)	6.17 m ² (66.41 sq ft)

WEIGHTS AND LOADINGS (Srs 300):

Operating weight empty	9,909 kg (21,846 lb)
Max payload	6,000 kg (13,228 lb)
Max fuel weight	4,230 kg (9,326 lb)
Max T-O weight	16,500 kg (36,376 lb)
Max ramp weight	16,550 kg (36,486 lb)
Max landing weight	16,500 kg (36,376 lb)
Max zero-fuel weight	15,400 kg (33,951 lb)
Max wing loading	279.2 kg/m ² (57.19 lb/sq ft)
Max power loading (without APR)	6.33 kg/kW (10.39 lb/shp)

PERFORMANCE (Srs 300):

Max cruising speed	246 kt (455 km/h; 283 mph)
Max rate of climb at S/L	183 m (600 ft)/min
Service ceiling	9,145 m (30,000 ft)
Service ceiling, OEI	4,275 m (14,020 ft)
T-O run	398 m (1,305 ft)
T-O to 15 m (50 ft)	754 m (2,474 ft)
Landing from 15 m (50 ft)	603 m (1,978 ft)
Range:	
with max fuel	2,701 n miles (5,003 km; 3,108 miles)
with 4,000 kg (8,818 lb) payload	1,549 n miles (2,870 km; 1,783 miles)
with max payload	393 n miles (727 km; 452 miles)
g limits: at MTOW	+2.5/-1
below 14,100 kg (31,085 lb)	+3/-1

ALenia/AERMACCHI/EMBRAER

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Development and promotion of the AMX attack fighter was undertaken under the name of AMX International. This company has now been dissolved, leaving the individual partners responsible for the final production aircraft and continued support of the Brazilian and Italian fleets. Production of a small follow-on batch for Venezuela has been abandoned.

ALenia/AERMACCHI/EMBRAER AMX

Brazilian Air Force designations: A-1A and A-1B

Italian Air Force name: Ghibli (Desert Wind)

TYPE: Attack fighter.

PROGRAMME:

DEVELOPMENT MILESTONES

Requirement issued	Jun 1977
First flight	15 May 1984
Production go-ahead	mid-1986
First flight, production	11 May 1988
First delivery (Italian AF)	Apr 1989

Resulted from June 1977 Italian Air Force specification for small tactical fighter-bomber; original Aeritalia/Aermacchi partnership joined by Embraer July 1980; formed AMX International to develop, market and manufacture aircraft. This now replaced by companies' individual efforts. Seven single-seat prototypes built (first flight 15 May 1984); production of first 30 (Italy 21, Brazil nine), and design of two-seater, began mid-1986; first production aircraft rolled out at Turin 29 March 1988, making first flight 11 May; second contract (Italy 59, Brazil 25, including six and three two-seaters respectively) placed 1988.

Deliveries to Italian Air Force (six for Reparto Sperimentale di Volo at Pratica di Mare) began April 1989; production A-1 for Brazilian Air Force (s/n 5500) made first flight 12 August 1989, deliveries (two to Nucleo A-1 training nucleus at Santa Cruz) following from 17 October 1989; in-flight refuelling test programme completed (by Embraer) August/September 1989; first flight by first (of three) two-seat AMX-T prototypes 14 March 1990 (MM55024), followed by second on 16 July; first flight of Embraer two-seater (serial number 5650), 14 August 1991; third production batch authorised early 1992 (one year late); first two-seater for Brazilian Air Force (5650) delivered 7 May 1992.

Italian single-seater production temporarily halted following delivery on 1 February 1993 of 72nd aircraft (MM7160); resumed late 1994, with both AMX and first production batch of AMX-T. Final Italian single-seater delivered in 1997; total 110, comprising 74 built by Alenia and 36 by Aermacchi. Batch 4 (35 AMX and 16 AMX-T) and Batch 5 (42 AMX and 9 AMX-T) cancelled. Final Italian two-seater followed in 1998; 26 built: 17 Alenia, nine Aermacchi. Production continued in Brazil, where 50th was delivered on 1 December 1998 and last in 1999.

Istrana- and Amendola-based AMX squadrons flew 252 combat sorties (667 flying hours) during Operation Allied Force against Yugoslavia in 1999, dropping 39 Opher LGBs.

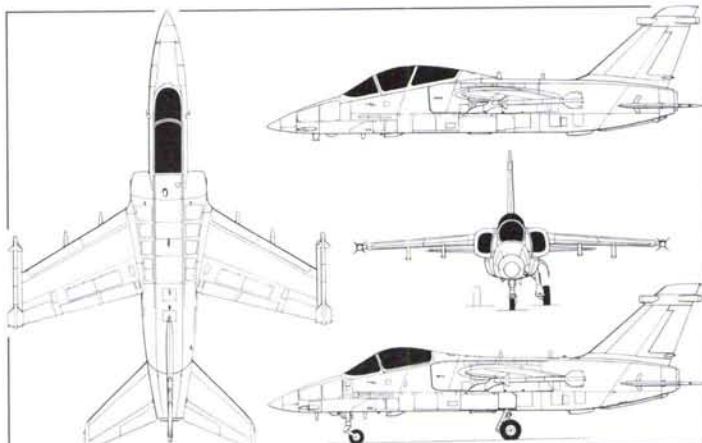
CURRENT VERSIONS: **AMX:** Replaced G91R/Y and some F-104G/S in Italian Air Force (eight squadrons originally planned) and some EMB-326GB Xavante in Brazilian Air Force for close support/interdiction/reconnaissance, sharing counter-air duties with IDS Tornado (Italy) and F-5E/Mirage 50 (Brazil); in service with five Italian Stormi (see table) and 10th and 16th Grupos (Brazil); Brazilian Air Force aircraft (designated A-1A) differ primarily in avionics and weapon delivery systems, have two 30 mm guns instead of Italian version's single multibarrel 20 mm weapon and are usually fitted with in-flight refuelling probes.

AMX-MLU: Mid-life upgrade originally to be undertaken jointly by Brazil and Italy, but subsequently abandoned because of high cost and limited funding. Italy then opted for more limited upgrade project to be undertaken by Alenia during 2006-09. Known as AMX-ACOL (Aggiornamento Capacita Operative e Logistica; Operational and Logistic Capabilities Update), this includes GPS navigation, an improved EW suite, updated communications and IFF, colour MFD, integration of Thales CLDP laser designator pod and ability to use newer weapons such as JDAM; consideration also reportedly given to installing new real-time reconnaissance pod. In this guise, Italy expects first upgraded aircraft (CSX7189) to be available for service in September 2006; 43 single- and 12 two-seat aircraft on order; further 11 options; delivery of 55th due end 2009; service life extended to 2015.



Brazilian Air Force two-seat AMX-T (Embraer)

1151726



Alenia/Aermacchi/Embraer AMX; upper side view shows two-seater (Dennis Punnett)

0507151

Super AMX: Designation of two-seater unsuccessfully offered to South Africa. Would have featured wide-angle HUD, 'glass cockpit', improved HOTAS, GPS, HMD, integrated defensive aids, new radar and new weapons.

Detailed description applies to single-seater except where indicated.

AMX-T: Second cockpit accommodated by removing forward fuselage fuel tank and relocating environmental control system; dual controls, canopy, integration of rear cockpit GEC-Marconi HUD monitor, and oxygen systems, designed/redesigned by Embraer; intended both as operational trainer and, suitably equipped, for such roles as EW, reconnaissance and maritime attack; most Italian AMX-Ts assigned to operational squadrons of 32nd Stormo; others assigned, one per squadron, as trainers. Brazilian designation A-1B.

AMX-ATA: Venezuela announced intent to acquire eight two-seaters in September 1999, but contract not finalised until 18 December 2002, by which time total had increased to 12, comprising eight standard trainer aircraft and four electronic warfare aircraft. Venezuelan aircraft were to have Elta EL/M-2032 radar and Elbit avionics. Deliveries were due to begin in 2005, but did not do so and it appears that procurement has been abandoned.

AMX-ATA 2: Light combat aircraft and advanced trainer for export with AMX-MLU avionics and non-afterburning EJ200 engine.

AMX-E: Original proposal envisaged two-seat EW version for use as escort jammer and SEAD platform with AGM-88 HARM missiles. Flight controls removed from rear cockpit. MM55027 used for development. Feasibility study completed but further development cancelled. Subsequently, AMX-E version resurrected in different form for Venezuela, which to receive four aircraft outfitted with Elta Electronics EW suite. System able to undertake passive and active countermeasures and uses elements of EL/L-8222 Comprehensive Self Protection Pod, which includes RWR, MAWS, LWR, electro-magnetic jammers and expendables.

CUSTOMERS: Total of 192 (136 Italy/56 Brazil, including 26 and 11 two-seaters) delivered by March 2000 (see table) to original partners. Italy has placed all remaining Batch 1 aircraft in reserve for possible sale. By 1998, 23 Batch 2 aircraft had been upgraded to 'pre-FOC' (full operational capability) standard and plans were in hand to modify 15 to FOC. These 38 plus all 56 remaining from Batch 3 (FOC), formed baseline fleet of 94, though AMI active inventory quoted as 104 aircraft by May 1999. Total of 66 aircraft (comprising 19 single-seaters from Batch 2 and 35 single-seaters and 12 two-seaters from Batch 3) earmarked for upgrade to ACOL configuration between 2005 and 2009, of which 55 on firm order. Brazil planned to begin major mid-life upgrade of 53 single- and two-seaters at end of 2004, with enhanced aircraft to be known as A-1AM and A-1BM respectively. Project includes installation of SCP-01 multimode radar, wide-angle HUD, three colour MFDs, NVG compatibility, HOTAS controls and a revised communications suite with datalink by Rhode & Schwarz. This upgrade will be accomplished over six years at estimated cost of USD400 million.

COSTS: USD18.75 million unit cost (1999) quoted for subsequently abandoned AMX-T Venezuelan programme.

DESIGN FEATURES: Intended for high-subsonic/very low-altitude day/night missions, in poor visibility and, if necessary, from poorly equipped or partially damaged runways. Required fatigue life of 4,000 hours being extended to 6,000 hours.

Wing sweepback 31° on leading-edges, 27° 30' at quarter-chord; thickness/chord ratio 12 per cent.

FLYING CONTROLS: Hydraulically actuated ailerons and elevators; leading-edge slats and Fowler double-slotted trailing-edge flaps (each two-segment on each wing, positions 0, 30 and 41°) actuated electrohydraulically; pair of hydraulically actuated spoilers forward of each flap pair, deployable separately in inboard and outboard pairs; fly-by-wire control of spoilers, rudder and variable incidence tailplane by Alenia/BAE Systems flight control computer; ailerons, elevators, rudder have manual reversion for fly-home capability, even with both hydraulic systems inoperative; spoilers serve also as airbrakes/lift dumpers.

STRUCTURE: Mainly aluminium alloy except for carbon fibre fin and elevators; shoulder-mounted wings, each with three-point attachment to fuselage, have three-spar torsion box with integrally stiffened skins; oval-section semi-monocoque fuselage, with rear portion (including tailplane) detachable for engine access.

Work split gives programme leader Alenia 46.7 per cent (centre-fuselage, nose radome, tail surfaces, ailerons and spoilers); Aermacchi has 23.6 per cent (forward fuselage including gun and avionics integration, canopy, tailcone) and Embraer 29.7 per cent (air intakes, wings, leading-edge slats, flaps, wing pylons, external fuel tanks and reconnaissance pallets); single-sourced production, with final assembly lines in Italy and Brazil.

LANDING GEAR: Hydraulically retractable tricycle type, of Messier-Bugatti levered suspension design, built in Italy by Magnaghi (nose unit) and in Brazil by ELEB (main units). Single wheel and oleo-pneumatic shock-absorber on each unit. Nose unit retracts forward; main units retract forward and inward, turning through approximately 90° to lie almost flat in underside of engine air intake trunks. Nosewheel hydraulically steerable (±6° normal; ±45° with full pedal movement), self-centring, and fitted with anti-shimmy device. Towing travel ±90°. Mainwheel tyres size 670x210-12 (18 ply), pressure 9.65 bar (140 lb/sq in); nosewheel tyre size 18x5.5-8 (10 ply), pressure 10.70 bar (155 lb/sq in). Hydraulic brakes and fully modulated anti-skid system. No brake-chute. Runway arrester hook. Minimum ground turning radius 7.53 m (24 ft 8½ in).

POWER PLANT: One 49.1 kN (11,030 lb st) Rolls-Royce RB 168 Spey Mk 807 non-afterburning turbofan, built under licence in Italy by Fiat, Piaggio and Alfa Romeo Avio, in association

AMX PRODUCTION									
Italy		Brazil							
Batch	AMX	First aircraft	AMX-T	First aircraft	AMX (A-1A)	First aircraft	AMX-T (A-1B)	First aircraft	Total
1	19	MM7089	2	MM55024	8	5500	1	5650	30
2	53	MM7108	6	MM55026	22	5508	3	5651	84
3	38	MM7161	18	MM55034	15	5530	7	5654	78
Total	110		26		45		11		192

Notes: Excludes seven single-seat prototypes and 12 aircraft for Venezuela.

ITALIAN AMX UNITS				
Squadron	Wing	Base	Type	First aircraft and acceptance
13 ^o Gruppo	32 ^o Stormo	Amendola	AMX	MM7112 Nov 94
			AMX-T ¹	MM55029 by Apr 95
14 ^o Gruppo	2 ^o Stormo	Rivoltò ²	AMX	MM7130 10 Jul 91
			AMX-T ¹	MM55028 24 Nov 94
28 ^o Gruppo ⁵	3 ^o Stormo	Villafranca	AMX	MM7129 Jun 93
			AMX-T ¹	MM55029 by Dec 94
101 ^o Gruppo ³	32 ^o Stormo	Amendola	AMX	MM7091 31 Jul 95
			AMX-T	MM55030 21 Nov 94
103 ^o Gruppo	51 ^o Stormo	Istrana	AMX	MM7098 30 Sep 89
			AMX-T ¹	MM55027 by Apr 95
132 ^o Gruppo	51 ^o Stormo	Istrana ⁶	AMX	MM7110 15 Nov 90 ⁴
			AMX-T ¹	MM55037 4 Dec 95

¹ One aircraft only
² At Istrana until February 1994
³ Unit initially re-equipped as 201^o Gruppo (until 31 July 1995); AMX OCU
⁴ Initial working up at Istrana
⁵ Disbanded 29 September 1997
⁶ Villafranca until March 1999

BRAZILIAN AMX UNITS			
Squadron	Wing	Base	First delivery
1 ^o Esquadrão 'Adelfi'	16 Grupo de Aviação	Santa Cruz	Formed 7 November 1990 ¹
1 ^o Esquadrão 'Poker'	10 Grupo de Aviação	Santa Maria	1996
3 ^o Esquadrão 'Centaurus'	10 Grupo de Aviação	Santa Maria	1998

¹ Out of Nucleo A-1, originally established 7 November 1988

with Companhia Eletro-Mecânica (CELMA) in Brazil. Self-sealing, compartmented, rubber fuselage bag tanks and two integral wing tanks with combined capacity of 3,500 litres (924.6 US gallons; 770 Imp gallons). Brazilian AMX carry 200 litres (52.8 US gallons; 44.0 Imp gallons) more internal fuel in additional saddle tank behind cockpit. Auxiliary fuel tanks of up to 1,100 litres (290 US gallons; 242 Imp gallons) capacity can be carried on each inboard underwing pylon, and up to 580 litres (153 US gallons; 128 Imp gallons) on each outboard pylon. Single-point pressure or gravity refuelling of internal and external tanks. In-flight refuelling capability (probe and drogue system) is standard.

ACCOMMODATION: Pilot only, on Martin-Baker Mk 10L zero/zero ejection seat; 18^o downward view over nose. One-piece wraparound windscreen (reinforced on Brazilian aircraft); one-piece hinged canopy, opening sideways to starboard. Cockpit pressurised and air conditioned. Tandem two-seat combat trainer/special missions version also produced, with Mk 10LY-2 (front) and Mk 10LY-3 (rear) seats.

SYSTEMS: Microtecnica environmental control system (ECS) provides air conditioning of cockpit, avionics and reconnaissance pallets, cockpit pressurisation, air intake and inlet guide vane anti-icing, windscreen demisting and anti-g systems. Duplicated redundant hydraulic systems, driven by engine gearbox, operate at pressure of 207 bar (3,000 lb/sq in); both actuate primary flight control system (aileron, elevators and rudder) and secondary (flap and slat system); No. 1 circuit additionally supplies outboard spoilers, nosewheel steering and gun; No. 2 also supplies inboard spoilers and landing gear actuation. Primary electrical system AC power (115/200 V at fixed frequency of 400 Hz) supplied by two 30 kVA IDG generators, with two transformer-rectifier units for conversion to 28 V DC; 36 Ah Ni/Cd battery for emergency use, to provide power for essential systems in the event of primary and secondary electrical system failure. Aeroeletrônica (Brazil) external power control unit. Fiat FA 150 Argo APU for engine starting, APU-driven electrical generator for ground operation. Liquid oxygen system.

AVIONICS: All avionics/equipment packages pallet-mounted and positioned for rapid access. Modular design and space provisions within aircraft permit retrofitting of alternative avionics.

Comms: UHF and VHF com, and IFF.
Radar: Pointer ranging radar in Italian AMXs is I-band set modified from Elta (Israel) EL/M-2001B and built in Italy by FIAR. Brazilian aircraft were originally intended to have TecnaSMA-built (Alenia) SCP-01 Scipio radar, but this was not installed at time of production due to local bankruptcies of two Brazilian companies selected to produce the radar. It will now be fitted as part of the mid-life upgrade.

Flight: Litton Italia INS, with standby AHRs and Tacan, for Italian Air Force; VOR/ILS for Brazil. Data processing, with Microtecnica air data computer. BAE Systems MED 2067 video monitor display in rear cockpit of two-seater, for use by instructor/navigator as HUD monitor.

Instrumentation: Alenia computer-based weapon aiming and delivery, incorporating radar and Alenia stores management system; digital data displays (OMI/Alenia head-up, Alenia multifunction head-down, and weapons/nav selector). Provision for night vision goggles.

Mission: Italian aircraft of 3^o Stormo equipped with Oude Delft Orpheus reconnaissance pods, and was an internal sensor suite being sought for deployment in 2001. This is believed to have been cancelled, but was to have comprised any one of three interchangeable Aeroeletrônica (Brazil) pallet-mounted photographic systems installed internally in forward fuselage, complementing external IR/EO pod on centreline pylon. Each system fully compatible with aircraft, and not affecting operational capability. Camera bay in lower starboard side of fuselage, forward of mainwheel bay.

Self-defence: Elettronica active and passive ECM, including fin-mounted radar warning receiver.

ARMAMENT: One M61A1 multibarrel 20 mm cannon, with 350 rounds, in port side of lower forward fuselage of aircraft for Italian Air Force (one 30 mm DEFA 554 cannon on each side in aircraft for Brazilian Air Force). Single stores attachment point on fuselage centreline, plus two attachments under each wing, and wingtip rails for two AIM-9L Sidewinder or similar IR air-to-air missiles (MAA-1 Piranha on Brazilian aircraft). Fuselage

and inboard underwing points each stressed for loads of up to 907 kg (2,000 lb); outboard underwing points stressed for 454 kg (1,000 lb) each; wingtip stations stressed for 113 kg (250 lb) each. Twin carriers can be fitted to all five stations. Total external stores load 3,800 kg (8,377 lb). Attack weapons can include free-fall or retarded Mk 82/83/84 bombs, laser-guided bombs, cluster bombs, air-to-surface missiles (including area denial, anti-radiation and anti-shipping weapons), electro-optical precision-guided munitions and rocket launchers.

Exocet firing trials conducted 1991; Marte trials 1994; carriage trials of GBU-16 Paveway II LGB on Italian AMX in 1995 and aircraft used Elbit Opher LGB system during Operation Allied Force over Kosovo, May-July 1999.

Upgraded Brazilian aircraft will have additional weapons capability, including indigenous MAR-1 anti-radiation missile as well as precision guided munitions. MAR-1 expected to enter service in 2005, with initial deployment on standard A-1A aircraft of 10^o Gav at Santa Maria. Upgraded Italian aircraft to be compatible with JDAM.

DIMENSIONS, EXTERNAL:	
Wing span:	
excl wingtip missiles and rails	8.875 m (29 ft 1½ in)
over missiles	9.97 m (32 ft 8½ in)
Wing aspect ratio	3.8
Wing taper ratio	0.5
Length: overall	13.23 m (43 ft 5 in)
fuselage	12.55 m (41 ft 2 in)
Height overall	4.55 m (14 ft 1¼ in)
Tailplane span	5.20 m (17 ft 0¾ in)
Wheel track	2.15 m (7 ft 0¾ in)
Wheelbase	4.70 m (15 ft 5 in)

AREAS:	
Wings, gross	21.00 m ² (226.0 sq ft)
Ailerons (total)	0.88 m ² (9.47 sq ft)
Trailing-edge flaps (total)	3.86 m ² (41.55 sq ft)
Leading-edge slats (total)	2.07 m ² (22.28 sq ft)
Spoilers (total)	1.30 m ² (13.99 sq ft)
Fin (exposed)	4.265 m ² (45.91 sq ft)
Rudder	0.83 m ² (8.93 sq ft)
Tailplane (total exposed)	5.10 m ² (54.90 sq ft)
Elevators (total)	1.00 m ² (10.76 sq ft)

WEIGHTS AND LOADINGS (all versions):	
Operational weight empty	7,000 kg (15,432 lb)
Max fuel weight: internal	2,720 kg (5,997 lb)
external	1,726 kg (3,805 lb)
Max external stores load	3,800 kg (8,377 lb)
T-O weight (clean)	9,694 kg (21,371 lb)
Typical mission T-O weight	10,750 kg (23,700 lb)
Max T-O weight	13,000 kg (28,660 lb)
Normal landing weight	7,000 kg (15,432 lb)
Combat wing loading (clean)	457.1 kg/m ² (93.62 lb/sq ft)
Max wing loading	619.1 kg/m ² (126.79 lb/sq ft)
Max power loading	265 kg/kN (2.60 lb/lb st)

PERFORMANCE (A at typical mission weight of 10,750 kg; 23,700 lb with 907 kg; 2,000 lb of external stores, B at max T-O weight with 2,721 kg; 6,000 lb of external stores, ISA in both cases):

Max level speed: at S/L	M0.83
at 9,140 m (30,000 ft)	M0.86
Max rate of climb at S/L	3,124 m (10,250 ft)/min
Service ceiling	12,800 m (41,995 ft)
T-O run at S/L: A	631 m (2,070 ft)
B	982 m (3,220 ft)